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ABSTRACT

To aid in the construction of effective task analysis inventories, this technical report discusses: (1) an optimum questionnaire length that adequately covers Marine tasks without unduly fatiguing respondents; (2) procedures for the phrasing of task statements to avoid ambiguities and be understandable to as broad a range of Marines as is possible; and (3) recommendations for inventory design and format. It is recommended that the Office of Manpower Utilization experiment with a "mini-booklet" that would substantially reduce the number of items, since some Marine Corps inventories have contained as many as 1,000 items. An experimental design is given for dividing a lengthy task inventory into a series of shorter inventories. There is an overlap of task statements in each small questionnaire booklet to provide adequate samples of responses to each item. Major attention is given to the wording of task statements and inventory instructions. Data are presented from the application of six readability formulas to nine task inventories. Reading comprehension levels of Marines at three bases are described and are compared with the comprehension levels required to understand task statements and instructions in the inventories. Guidelines for simplified wording of task inventory items and methods for measuring readability are outlined. A single booklet containing both test statements and answers is presented to replace the traditional two-booklet format. Also discussed are studies of the effects of anonymus versus identified responses to task inventories. The Appendix includes the Dale list of 3,000 most familiar words and an activity verb list. (Author/CP)

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TASK INVENTORY CONSTRUCTION

Akemi Kishi

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Technical Report No. 14

EVALUATION OF THE MARINE CORPS TASK ANALYSIS PROGRAM

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California State University, Los Angeles
June 1976

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This technical report is designed to aid in the construction of effective task analysis inventories. The objectives of the research conducted here were to determine an optimum questionnaire size that would adequately cover the tasks without unduly fatiguing the Marine respondents; to develop procedures for the phrasing of task statements to avoid ambiguities and be understandable to as broad a range of Marines as is possible with a paper and pencil inventory; and to develop recommendations for inventory design and format. The result of studies of task inventory size (some Marine Corps inventories have contained

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as many as 1,000 items) is a recommendation that OMU experiment with a "mini-booklet" format that would substantially reduce the number of items to which an individual Marine would be required to respond. An experimental design is given for dividing a lengthy task inventory into a series of shorter inventories. There is sufficient overlap of task statements in each small questionnaire booklet to provide adequate samples of response to each item. Major attention is given to the wording of task statements and task inventory instructions. Data are presented from the application of six measures of readability to nine task inventories. Reading comprehension levels of Marines at three Marine Corps bases are described and are compared with the comprehension levels required to understand task statements and instructions in task inventories. Guidelines for wording of task inventory items to improve understanding are provided. Methods for measuring readability are outlined. OMU has traditionally used a two-booklet format for its task inventories with one booklet containing the task statement and the other being the answer booklet. Research resulted in a single task inventory booklet that includes response categories to questions and task statements on the same page and immediately folowing the items. Transfer of responses to computer storage is accomplished by the key-to-disk method. Also discussed are studies of the effects of anonymous versus identified responses to task inventories.

SUMMARY

This technical report is designed to aid in the construction of effective task analysis inventories. The objectives of the research conducted were to determine an optimum questionnaire size that would adequately cover the tasks without unduly fatiguing the Marine respondents; to develop procedures for the phrasing of task statements to avoid ambiguities and be understandable to as broad a range of Marines as is possible with a paper and pencil inventory; and to develop recommendations for inventory design and format.

The result of studies of task inventory size (some Marine Corps inventories have contained as many as 1,000 items) is a recommendation that OMU experiment with a "mini-booklet" format that would substantially reduce the number of items to which an individual Marine would be required to respond. An experimental design is given for dividing a lengthy task inventory into a series of shorter inventories. There is overlap of task statements in each small questionnaire booklet to provide adequate samples of response to each item.

Major attention is given to the wording of task statements and task inventory instructions. Data are presented from the application of six measures of readability to nine task inventories. Reading comprehension levels of Marines at three Marine Corps bases are described and are compared with the comprehension levels required to understand task statements and instructions in task inventories. Guidelines for wording of task inventory items to improve understanding are provided. Methods for measuring readability are outlined.

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Also discussed are studies of the effects of anonymous versus identified responses to task inventories.

TASK INVENTORY CONSTRUCTION

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I

INTRODUCTION

Task Inventory Construction is one of eight research areas requested by the U. S. Marine Corps for study and review by the research staff at California State University, Los Angeles. From their first preview and briefing on the OMU Task Analysis Program, members of the research staff expressed concern about the procedures used to generate basic data on what Marines actually do in the performance of assigned duties or jobs. Research staff members questioned the reliability of and dependability of information secured through administration of the traditional task inventories to Marine Corps job incumbents.

Studies of the task inventory construction methods used by the staff of the Office of Manpower Utilization HQMC (OMU) suggested that there might be a number of problem areas in the existing procedures. Some of the apparent problem areas identified were:

1. The procedure used in collection of information about tasks on which inventory statements were based.
2. The format of task inventory booklets.
3. Sequencing of task inventory statements in these booklets.
4. Effect of booklet length on the reliability and validity of responses.
5. Effect of the identification of individual Marine respondents on the validity of certain categories of responses.
6. Reading levels of Marines as compared to readability levels of task inventories.

7. Attitudes of Marines towards task inventory questionnaires.

To examine and evaluate these problem areas, the research staff used a variety of research approaches, including a study of current Marine Corps Task Analysis procedures, the administration of reading ability tests to samples of Marines, analysis of readability of Task Inventories, a review of the literature of Task Inventory Construction and readability measures, and the relevance of several statistical procedures.

This report outlines staff experience in following these approaches. Chapter II defines terms and states major hypotheses. Chapter III discusses the setting, background and rationale behind these studies. Chapter IV focuses attention on the mechanics of task inventory construction--the steps taken in preparing each inventory. Chapter V reports our search for significant data and findings with respect to the format of task inventory booklets, the possible influence of personal identification of Marine respondents, the relevance of booklet length, and the implications of readability as a factor in the quality of information provided by the traditional procedure. Chapter VI summarizes findings and conclusions.

II

TASK INVENTORY CONSTRUCTION AND TASK ANALYSIS

A. AREAS OF RESEARCH ASSIGNED TO ONR-USMC RESEARCH STAFF AT CALIFORNIA STATE UNIVERSITY, LOS ANGELES.

In its studies of the Marine Corps Task Analysis Program, the research staff at California State University, Los Angeles and the HQMC Study Advisory Committee for evaluation of the Marine Corps Task Analysis Program agreed upon eight primary research areas for study, these are:

Research Area 1. Task Analysis Observation and Interview Procedures

Research Area 2. Task Inventory Construction

Research Area 3. Occupational Field Sample Size

Research Area 4. Computer Procedures and Data Analysis

Research Area 5. OMU Organization and Personnel

Research Area 6. Orientation, Training and Team Performance

Research Area 7. Peace Time Task Analysis and Its Relation to War Time Conditions

Research Area 8. Worker Characteristics.

This report is concerned with Research Area 2 - Task Inventory Construction. The results of studies in the other research areas are reported in separate technical reports.

B. TASK INVENTORY DEFINED.

Task Inventories are questionnaires consisting of a comprehensive set of specific statements of tasks performed by Marines in a given Occupational Field

(OF) as well as questions designed to secure from each responding Marine the following information:

1. What the Marine really does.
2. Why the Marine does it.
3. How the Marine does it.
4. At what skill level (learner, worker, first-line supervisor, or staff supervisor) the Marine performs.

Each questionnaire is usually divided into three parts:

Part I is designed to acquire standard demographic information from the responding Marine as well as to define further the Marine's job-related and military background.

Part II contains the list of task statements.

Part III contains a series of job satisfaction questions.

Each Task Inventory Questionnaire applies to an entire Occupational Field (OF) and therefore must cover all Military Occupational Specialties (MOS) encompassed within that field. The recommended range for the number of items or questions used is from 200 to 1,000, with a maximum of 2,000 items permitted by constraints within the computer program used for processing the questionnaire responses. The primary subject matter of a Task Inventory Questionnaire is the assignment to an Occupational Field. The Occupational Field is divided into Military Occupational Specialties. Each Military Occupational Specialty is divided into duties, and each duty is composed of individual tasks. Normally, the individual task is the smallest subdivision identified.

C. THE PRINCIPAL HYPOTHESES TESTED.

A preliminary study of the methods traditionally used and the problems encountered in the construction of task inventories was made. This preliminary study included several steps, such as:

1. Interviews with Office of Manpower Utilization (OMU) staff members.
2. A study of existing task inventory questionnaires.
3. A review of Marine Corps training manuals.
4. Interviews with individual Marines and with training school instructors.

As a result of this preliminary study, a number of both major and minor working hypotheses were developed. Studies then sought to obtain the data necessary to test these hypotheses. Conclusions were then drawn from these findings, and recommendations to OMU were formulated.

III

BACKGROUND, SCOPE, AND METHODOLOGIES USED

A. BACKGROUND.

Task inventory construction is a major part of the Marine Corps Task Analysis Program (MCTAP) which was initiated in 1969. The MCTAP is a responsibility assigned to the Office of Manpower Utilization, Headquarters, Marine Corps.

Task inventory construction is phase 3 of a seven step procedure applied to each OF under study. These steps are:

1. Study phase.
2. Observation and interview phase.
3. Task inventory construction phase.
4. Inventory administration phase.
5. Processing phase.
6. Analysis phase.
7. Final report phase.

The task inventory is a questionnaire covering tasks at all levels of proficiency as well as questions about incumbent experience and training. The initial questionnaire is developed during the study phase. This initial questionnaire is then augmented by questions derived during the observation and interview phase. The task inventory construction phase is then used to rework and refine the questionnaire so that it will have maximum effectiveness in eliciting accurate and useful responses from the Marine respondents in the OF.

Questionnaire responses are then subjected to analysis by computer. This analysis reveals variations in job duties and performance that can lead to

improvements in OF classification, assignment, training, grade and MOS structure, job requirements, and job specifications.

4. SCOPE.

The specific objectives of this study were to determine an optimum inventory size that would have equal or greater effectiveness than previous inventories, and to develop procedures for the phrasing of task statements to avoid ambiguities and be understandable to as broad a range of Marines as is possible with such a paper and pencil instrument. A related objective was to develop recommendations for inventory design and format.

Since the task inventory questionnaire is one of the most critical tools of the task analysis (TA) operation, these instruments - and the process by which they are developed - attracted immediate interest and concern on the part of research staff members. Examination of these questionnaires raised such questions as:

1. Are the task inventories designed and adequately tested to ensure that they can and do provide accurate, dependable data about what Marines actually do in the performance of their assignments?
2. Is the readability level of the materials in the inventories properly matched to the reading capabilities of those who are expected to respond to them?
3. Are inventories designed and presented in a form that will gain and hold the interest, attention, and cooperation of those who are asked to complete them?
4. Are the task inventories too long and time-consuming? What is an optimum length?

It is apparent that the credibility, dependability, and usefulness of

TA reports and recommendations are directly affected by the quality of information derived from the administration of task inventory questionnaires. Thus, answers to the above questions are critical to the significance and effectiveness of the entire TA program. For that reason, they became one of the eight major Research Areas in our study.

C. METHODOLOGIES USED.

Approaches used in this research were many and varied. As a preliminary phase in the evaluative study of the TA program of OMU, our research staff members received a series of briefings on OMU practices and experience. These reviews were supplemented by direct observation of the TA operation in progress, with ample opportunity to examine and discuss the forms, instruments, and devices OMU has developed and used in various phases and stages of the program. Among materials examined were service school training manuals, task inventory booklets, computer programs, and interim and final reports of completed TA studies.

For purposes of the research area of task inventory construction, staff members observed directly the first four phases of several ongoing TA programs: the study phase, observation and interviewing, task inventory construction, and inventory administration. During these observations, data were collected, and selected portions of these data were subsequently subjected to critical statistical analysis.

Research staff members made an exhaustive study of the literature concerning questionnaire construction, format, question phrasing, word-list utilization, etc. An especially intensive study was made of the methodologies used in measuring readability levels of questionnaires. Special attention was directed to practices which appeared to be effective when used in a

civilian environment and might be similarly effective when applied to CMU's analysis of task inventories.

IV

TASK INVENTORY CONSTRUCTION - GENERAL CONCEPTS

A. THE NATURE OF INVENTORY STATEMENTS.

The philosophy of the task analysis process proposes to include as many tasks as possible in each individual inventory. The recommended number of statements ranges from a minimum of 200 to a maximum of 1,000, with an absolute maximum of 2,000, which is determined by the number of task statements that the computer can manipulate.

To date, inventory questionnaires have been constructed in a six-phase sequence, namely, pre-study, initial task list development, initial task list review during observation-interview, task inventory preparation, technical review of contents, and in-house technical review for format.

Pre-study. The first phase is to gather background data from several sources: (1) cognizant agencies at HQMC are interviewed concerning the OF under review; (2) resulting ideas and suggestions concerning the OF are collected and reviewed; (3) an interim evaluation is conducted to ascertain whether the study should proceed.

Initial Task List Development. An initial list of tasks is developed using such sources as (1) a review of the literature pertaining to the OF, (2) input from OF specialists, (3) input from MOS specialists, and (4) input from other appropriate technical experts.

Initial Task Review List. Through observation and interview of Marine billet incumbents, the initial task list is augmented and tentatively validated. Each statement is reviewed by the incumbents for clarity and accuracy.

Task Inventory Construction. Task analysts and task inventory construction specialists then convert the augmented task list into a full-scale task inventory questionnaire.

Technical Review of Content. Technical advisors again review the statements for completeness and validity. They then review the questionnaire to make sure that it achieves the prime objective of discriminating among job types, skill levels, and other categories of OF-members.

In-House Technical Review. A final review is made by task analysis personnel to ensure that the questionnaire meets all of the specified format criteria.

B. INVENTORY DESIGN AND FORMAT.

The inventories presently in use include sections on: (1) background information; (2) general inquiries; (3) duties and tasks, and (4) job satisfaction. Sections (1) and (4) contain questions which are similar in all studies and are designed to obtain specific demographic and job satisfaction information, respectively.

Background Information. The section on background information consists of questions pertaining to: (1) identification, such as pay grade, primary and other MOS's, and sex; (2) job location, such as type command, reporting unit code, and geographic area; and (3) experience and other job related information, such as time in current assignment, primary MOS, and active service; number of subordinates supervised; highest educational level completed; reenlistment plans; job interest; and utilization of talents and training.

General Inquiries. The section on general inquiries consists of questions to ascertain (1) the Marine's participation in off-duty college coursework; (2) his participation in professional service schools and in professional service correspondence courses; and (3) various questions about his job requirements.

Duties and Tasks. This section is designed to obtain specific information as to time spent on the various duties and tasks identified during the five-phase inventory construction process. Each question in this section pertains to a specific duty or task which may be or should be performed by the Marine occupying a given billet.

Unlike the background and job satisfaction sections, the part dealing with duties and tasks is unique to each inventory, and this section is prepared from data obtained in the Study Phase and the Observation and Interview (O&I) Phase. It is from the final data gathered during the O&I that task statements are prepared. Precise methods of developing task statement items have been largely determined by the individual teams responsible for each OF under study.

The Observation and Interview phase is described in "A Synopsis of the U.S. Marine Corps Task Analysis Program", as follows: "After preliminary investigation is conducted in the Study Phase, analysts then travel to selected Marine Corps commands to observe and interview Marines working in the field of study, in the actual performance of their jobs. All pay grades in each billet and MOS of the OF are interviewed so that the total spectrum of the field's work is represented. Work data are broken down into four categories: Jobs, Duties, Tasks, and Elements. For example: Job-Automotive Mechanic; Duties - Tune Engine; adjust brakes, repair exhaust systems, etc. Tasks (of tune engine only) - Change points, change plugs, adjust carburetor, etc. Elements (adjust carburetor only) - Adjust mixture, adjust idle, change filter, etc." [1]

1. "A Synopsis of the U.S. Marine Corps Task Analysis Program", Hdqtrs., USMC, OMU (Code MPU), MCB, Quantico, VA., February, 1974.

As a result of the early findings in our research, CMU task analysts undertook an experiment to try to save time in the preparation of inventory statements. This new approach has been called the "Document Research" method. It entails the preliminary creation of a list of task statements based upon a study of documents, school programs of instruction, and other U.S. Armed Forces task inventories pertinent to the field under study. After a list of task statements has been compiled and refined, it is reviewed by senior enlisted men in the OF under study, and finally by task analysts from CMU and by technical advisors from the OF. Suggested changes, recommendations, additions, or deletions are evaluated, and appropriate modifications are incorporated into a preliminary task inventory.

As a means of testing this method, a second task inventory was constructed concurrently by a second TA team using the traditional O&I method. When both task inventories were completed, a meeting of the two TA teams was held to reconcile differences between the two inventories and to create a single final form. The resulting inventory contained only about 100 more task statements than did the version resulting from the document research method. The conclusion is that a more thorough review, during the Study Phase, of training manuals and other documents describing OF tasks, when followed by interviews and reviews with "experts" of preliminary task statements, speeds up the process of developing task statements for inventories and promises to reduce time and costs in the O&I Phase.

Job Satisfaction/Dissatisfaction. The final section of the inventory contains questions designed to discover the degrees of respondent satisfaction with the job, such as pride in being a Marine, relationships with his boss, job utilization of talents, how he thinks other people regard his job, etc.

C. SEQUENCING THE TASK INVENTORY STATEMENTS.

Step one in the inventory development phase is to determine what actual tasks are to be included in the inventory. The next step is to arrange the tasks into some orderly and rational sequence. In the past, the sequencing of the items was left up to each individual TA team. Methods varied; items were arranged by (1) complete randomization, (2) organization by duty areas, and (3) an alphabetical listing of tasks.

The randomized arrangement is presumably the simplest sequencing form to achieve, since the statements can be left in the sequence in which they were gathered, or each statement may be assigned a number and the sequence ordered by use of a table of random digits.

A combination of methods (2) and (3) has also been used. In order to develop an inventory that is easily comprehensible to the reader and that also prevents response bias, an arrangement of task items alphabetically under duty areas is believed to be effective in facilitating accurate responses. This form of organization is used by the United States Air Force in its Task Analysis inventories. Statements are assigned to "an outline of duties which are mutually exclusive and equally general in coverage, and each duty may first be broken into a few broad and mutually exclusive activity statements or subheadings which completely cover the duty."[2] This method is flexible in that more specific items can be included if the duty area encompasses more task items.

Another method of sequencing task items has been suggested for experimental administration by our research staff members who studied this question. This approach requires definition of criteria by which statements will be

2. Archer, Wayne B. and Fruchter, Dorothy A., THE CONSTRUCTION, REVIEW, AND ADMINISTRATION OF AIR FORCE JOB INVENTORIES, Technical Documentary Report PRL-TDR-63-21, August, 1973.

ordered. The analyst determines whether the OF under study is a hardware field or software field and if so, whether it includes highly specialized duty areas or more generalized duty areas.

The table below illustrates how the components determine task item arrangement:

	Hardware	Software
Specialized	By Equipment By Objective	By Duty Area By Objective
Generalized	By Equipment	By Duty Area

In an occupational field such as Avionics (hardware, specialized) the resultant structure might appear as follows:

Black Box AM--XX (Equipment)

Maintenance (Objective)

Task 1

Task 2

Task N

Repair (Objective)

Task 1

Task 2

Task N

etc.

Within each subgroup, task statements are randomized to avoid alphabetical response bias.

Objectives can be explicit or implicit, depending upon what is determined during the O&I phase with respect to the degree to which similar tasks are

performed by different kinds of incumbents for different objectives.

Operationalizing such a structure requires much effort and attention to detail on the part of task analysts. A complex occupational field may include all four classifications.

Because time has not permitted careful testing of this suggested arrangement, and in view of its requirements of effort and attention noted above, no specific recommendation for changing sequencing procedure is proposed here, but further attention is given to the problem in the chapter that follows.

V

TESTING THE MAJOR AND MINOR HYPOTHESES

In Chapter I, seven problem areas were described. Hypotheses concerning these problem areas were formulated. Extensive research was conducted into the subject matter of these hypotheses, data were collected and analyzed, and conclusions were drawn. During this process, other minor hypotheses were developed, and questions were raised which required answers. This chapter describes the research performed, the tests conducted, the conclusions drawn, and the recommendations to be made.

A. THE TWO-BOOKLET QUESTION AND ANSWER FORMAT VS. THE ONE-BOOKLET FORMAT AND OTHER FORMAT RELATED CONSIDERATIONS.

1. The Major Format Hypothesis. The first principal hypothesis to be formulated was: The two-booklet form of the questionnaire, one booklet for questions and one for answers, tends to encourage unreliable responses from the Marines being interviewed.

2. The Two-Booklet Format. As described in the preceding chapter, when the study commenced, OMU was using a two-booklet format. One booklet contained a set of instructions, a section on background information about respondents, a set of task statements, and a job satisfaction questionnaire. A second booklet contained spaces for recording answers. This second booklet utilized Farrington 3030 forms which are designed to be read directly into a computer by means of an optical scanning device. In use, the two-booklet format required the Marine respondent to go back and forth between the two booklets in order to record his response to each item.

Difficulties Observed. Early in the research project, research staff members became aware that the two-booklet format combined with the optical scanning reading device created two major difficulties. First, since the optical scanning device reads marks as responses, accidental, unintended marks in the answer booklet could cause erroneous answers to be recorded. In the process of moving back and forth between the two booklets the Marine respondents tended to make many misleading marks. As a result, a considerable amount of time had to be spent by team members in erasing these random marks in the booklets in order to avoid creating errors in the scanning process. This was a slow, tedious, and expensive task. Second, both our staff members and OMU were in agreement that the two-booklet system was one that could be easily confusing to some Marines, frustrating and irritating to most of them and fatiguing to many of them. These factors plus the need to keep going back and forth between two booklets could lead to an unacceptably high number of errors in recording responses and could therefore reduce the reliability of inventory results below acceptable levels.

Research Performed. Because of our early concern about these potential difficulties in using the two-booklet format, research staff members decided to undertake and carefully observe such an administration using the separate task inventory booklets and the separate answer booklets. This experience reinforced our earlier concerns about the cumbersome nature of this procedure. We informed OMU staff members of these concerns. OMU agreed with our observations and immediately proceeded to search for alternative methods of recording responses to task inventory items. OMU's willingness to undertake this investigation was gratefully

appreciated by the research staff, and we wish to acknowledge that all subsequent research on this question was performed by OMU.

Among the alternatives proposed, one method appeared to be promising. This involved the acquisition of a Westinghouse recording system. In the Westinghouse system, the Westinghouse W2300 forms would replace the Farrington 3030 forms. It was proposed that the W2300 forms be combined with the task inventory statements in one booklet. This proposal was recommended by the Director, Manpower Plans & Policy Decisions, in his letter of 13 December, 1974, to the Director, Information Systems Support and Management Division. At that time, we supported the proposal on the basis of (1) the possible cost savings that should result, and (2) the important improvements in quality of data and in the value, reliability, and credibility of the entire Task Analysis Program.

OMU, however, because the high capital investment in new scanning equipment required by the Westinghouse system was incompatible with then current Marine Corps efforts to reduce costs, decided to investigate other available methods. To that end, the possible adaptation of the Air Force Task Inventory answer sheet was reviewed. The Air Force offered its assistance in "reading" the answer sheets at Lackland AFB with its OCR system. However, factors and costs suggested that other alternatives be reviewed before a final decision was made.

The Final Decision. The result of these studies was preparation of a single task inventory booklet that includes both questions and task statements and responses on the same page immediately following the items. It is designed for direct key-to-disk transfer of the responses that are pre-coded on each page.

Conclusions and Recommendations. The hypothesis that the two-booklet format tended to produce unreliable responses was supported and a one booklet format was developed.

Initial task inventories that have been prepared for evaluation in this manner have produced satisfying results. Basic processing costs appear to be about the same as the older system, but considerable staff time has been saved by elimination of the answer booklets that required cleaning up in preparation for the former scanning process. The new format appears to be less prone to response errors than the old answer sheets, and the separate answer booklets used previously. It also appears that chances for error in the process of transferring responses from booklets to computer tape have been reduced.

3. Acknowledgement to OMU. Throughout the study of task inventory formats, OMU took the initiative in experimenting with alternatives and evaluating cost-benefits, reliability, and practicality of different systems. Members of the OMU staff not only deserve recognition for these efforts, but they must also be given credit for the development of the new format and scoring system, and for conducting experiments that have demonstrated the superiority of the new method.

As a result, an interesting sidelight is that recommendations have been made and methodologies have been developed and implemented prior to the completion of our research and prior to the filing of our final report. This is in contrast to the usual procedure in which sponsors await the filing of a final report before considering recommendations or making changes.

4. Other Format and Related Hypotheses. During our research we developed two significant hypotheses with respect to format and with respect to the methodology to be used in the gathering and formulation of task inventory statements. These hypotheses were tested, conclusions were drawn, and recommendations prepared.

a. Task Inventory Statement Sequencing Methodology.

Hypothesis: The method of sequencing task statements in the inventory can influence the validity of responses.

Research performed by our staff indicates that this hypothesis is true. A number of sequencing methods was investigated and a new method was developed based upon a definition of criteria by which the statements will be ordered. A discussion of this method is included in the preceding Chapter IV, Section C., Sequencing the Task Inventory Statements.

b. The "Document Research" Method of Task Inventory Statement Collection.

Hypothesis: The new "Document Research" method of task inventory statement collection is efficient, effective, and less costly than is the O&I method.

Research performed by our staff indicates that this hypothesis is also true. The "Document Research" method is described in detail in Chapter IV, Section B., Inventory Design and Format. This is another example in which OMU adopted and implemented a recommendation prior to the filing of the final report.

B. IDENTIFICATION VS. ANONYMITY OF RESPONDENTS.

A second principal hypothesis to be tested held that: Identification of respondents tends to make their responses to the job satisfaction questionnaire less reliable.

Part IV of the task inventory questionnaire consists of 28 questions (see Table 1) designed to discover from the Marine respondent his satisfaction/dissatisfaction with his job environment. It has been the practice of the Marine Corps to require the respondent to identify himself in Part I of the questionnaire. Since a number of the questions in Part IV express the respondent's attitude towards his superiors and co-workers, research staff members were of the opinion that the above hypothesis should be tested by comparing responses to the job satisfaction/dissatisfaction questions for anonymous and identified subjects. Of the 28 questions, numbers 1, 3, 4, 7, 11, 14, 16, 18, 20, 23, and 26 had some relationship to superiors and co-workers, with questions 4, 18, 20, and 26 involving direct references. It is clear that support of the hypothesis would require a significant statistical difference in the replies to questions 4, 18, 20, and 26 by members of the anonymous and identified groups.

In administering the task analysis questionnaire for OF 46 (Photography), Marines in one sample were asked to complete the identifying information called for on the task inventory questionnaire. Marines in the other sample omitted such data. The results are shown in Table 2. Statistical tests of the significance of differences between the two groups showed responses to only four of the 28 items (items 1, 5, 24, and 26) to be significant at the .05 confidence level. Surprisingly, none of these four items is among those we hypothesized would be most sensitive to bias with respondent identification. Our conclusion from this study is that, in the Marine Corps setting, only minimal and generally non-significant differences result from identified respondents to task inventories as compared with anonymous responses. The Air Force came to this conclusion some time ago in its task analysis

TABLE 1

Job Satisfaction/Dissatisfaction Questionnaire

Source: Part IV, Task Analysis Inventory, OF 46 (Photography)

1. Being treated fairly.
2. Doing interesting work.
3. Being respected by other Marines.
4. Having a supervisor who cares about your problems.
5. Being at a duty station you like.
6. Being well paid.
7. Feeling that you are trusted.
8. Knowing you are doing an important job.
9. Being proud of what you accomplish.
10. Good living conditions.
11. Getting the recognition you deserve.
12. Seeing yourself become more proficient.
13. Having a job that lets you lead a satisfying personal life.
14. Good working conditions.
15. Being respected by civilians.
16. Being kept informed.
17. Ability to act on your own initiative.
18. Having competent leaders.
19. Being of service to others.
20. Having dependable co-workers.
21. Opportunity for promotion.
22. Opportunity to do primary job.
23. Being with people you like.
24. Being well-trained for your job.
25. Opportunity to prove yourself.
26. Seeing the results of your work.
27. Your present job (overall).
28. The Marine Corps (overall).

TABLE 2

Comparison of Anonymous vs. Identified Subjects' Responses to Job Satisfaction Items on OF 46 (Photography) Questionnaire

Total Population = 217
N. Anon = 51
N. Ident = 166

7 Point Scale
1 = Very Dissatisfied
7 = Very Satisfied

ITEM	ANON N = 51		IDENT N = 166	
	M	Sd	M	Sd
(1.)	4.1042	1.9391	4.6875	1.7578
2.	4.1277	1.9959	4.1156	2.0587
3.	4.4750	1.3962	4.7068	1.5403
4.	4.1707	2.2729	4.4370	2.0022
(5.)	4.3023	1.9711	3.5000	2.1635
6.	3.9783	1.8590	3.8070	1.6800
7.	4.9286	1.8948	4.7077	1.9785
8.	3.9231	1.7886	3.9091	2.0165
9.	4.9302	1.9930	4.7846	2.0305
10.	3.5143	2.3588	3.6581	2.0388
11.	3.4865	1.9538	3.5000	1.8644
12.	4.6667	1.7480	4.5161	1.9571
13.	3.8780	1.8636	4.2000	1.9391
14.	4.0573	1.9342	3.7419	1.9471

ITEM	ANON		IDENT	
	M	Sd	M	Sd
15.	3.8947	2.0493	4.2115	1.9645
16.	3.4146	2.0833	3.4922	1.8666
17.	4.2326	2.1549	4.3906	2.0775
18.	4.0488	2.1179	4.0079	2.1370
19.	5.000	1.2773	4.7190	1.7212
20.	4.6444	1.5938	4.4885	1.7446
21.	3.7909	1.7328	4.1463	1.9241
22.	3.9474	1.9049	3.7563	1.9999
23.	4.6047	1.7137	4.4958	1.6237
(24.)	4.9512	1.6668	4.2558	2.0395
25.	4.2895	2.0119	4.1525	2.1575
(26.)	5.4091	1.4666	4.8500	1.8693
27.	4.5714	2.2223	4.3143	2.2042
28.	4.0213	2.1287	3.9433	2.1889

Circled items were found to be significant by t-tests ($p < .05$, two tailed)

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studies, and it continues to require identification of respondents on task inventories.

C. LONG VS. SHORT TASK INVENTORIES.

1. Using the Traditional Full-Length Inventory Booklet. The third principal hypothesis to be tested holds that: Lengthy task inventory questionnaires tend to result in unwarranted fatigue in the Marine respondent giving rise to the potential for unreliable responses.

In its TA study of an OF, OMU strives to include every essential task in its task inventory for that field. As noted, this has resulted in questionnaires of as many as 1,000 items, requiring as much as three to four hours for completion by Marine respondents. A review of the literature indicates that questionnaires requiring more than from one-half hour to one hour for completion result in less reliable data than shorter inventories.[3] It is contended that longer questionnaires lead to fatigue, diminished interest in completing the task, and probabilities of reduced reliabilities. Reviews of the experiences of the Marine Corps over a period of some seven years and that of the Air Force for some nine years, at the time this report is written, suggest that the variations in administration of questionnaires and inventories in a civilian setting may be quite different in effect from those of administration of similar instruments to military personnel in a more disciplined situation. Reports of difficulties arising from the length of inventories in both military services have been extremely rare. Two of our studies tend to support the feasibility of using lengthy questionnaires in military organizations.

3. Derman, Diran, French, John W., and Harman, Harry H., VERIFICATION OF SELF-REPORT TEMPERAMENT FACTORS, December, 1974, Technical Report No. 6, Research Sponsored by Office of Naval Research.

a. The Attitude Survey on Inventory Length.

As a means of evaluating the attitude of Marine Respondents toward long task inventories, our research staff members developed and administered an attitude survey to be used with respondents following their completion of the long-form inventory booklets.

Because the attitude survey covers reading difficulty and other items as well as inventory length, the general discussion of the survey is included in the section on readability that follows in this chapter. The format used in the survey may be found in Appendix D. Of the nine questions used, three questions relevant to inventory length were included:

1. I found it interesting to take.
2. I found it easy to get through.
3. The inventory was too long.

Results of the survey are shown in Table 11, also in the Appendix. A scale of 1 to 7 ranging from "strongly agree" to "strongly disagree" was used. Three OF's were tested: OF02 (Intelligence Officers), OF 44 (Legal Services), and OF 57 (Nuclear, Biological, Chemical). For Question 1, the mean score for all three fields was 2.4, or roughly midway between "agree" and "somewhat agree". For Question 2, the mean score was 2.1, that is very close to "agree". For Question 3, the mean score was 4.1, or close to "neither agree nor disagree". The conclusions reached from the survey are that Marine respondents find the inventory interesting to take, find it easy to get through, and are undisturbed by its length.

b. The Effect of Inventory Length Upon Task and Pay Grade Differentiation.

During the course of our research concerning inventory length, a

subsidiary hypothesis was formulated and tested: Lengthy inventories tend to reflect unreliable responses in terms of lack of logical differentiations between Officer and NCO tasks and among NCO's in different pay grades.

Our research staff members performed a statistical analysis of task inventories for the three OF's (02, 44, and 57) involving comparison of response distributions, analysis of variance, and tests of significance of differences between officers and NCO's and within the NCO groups. Results disproved the hypothesis. The analyses reflected logical differences between tasks performed by officers and NCO's. There was some overlap in the higher NCO pay grades, as would be expected if the data were reliable, since both officers and senior NCO's are supervisors and not primarily technicians. Logical differences were also found among NCO's in different pay grades. NCO's in the middle pay grades were performing tasks appropriate to their ranks, and lower level enlisted grades were performing more routine tasks.

2. <u>The Possible Use of Multiple Mini-Length Inventory Booklets</u>. A review of the literature caused our research staff members to formulate the following hypothesis: Breaking up lengthy inventories into short mini-booklets will improve the accuracy and validity of responses.

At the writing of this report, the testing of this hypothesis has not been completed; as a result the hypothesis has been neither accepted nor rejected. However, experiments have been made in breaking lengthy inventories into smaller packages, and it is recommended that OMU proceed with the administration of the newer mini-booklet inventories.

The purpose of the mini-booklet method is to reduce the total number of

task statements to which any one Marine has to respond. A promising alternative to lengthy inventories was found in an experimental design developed in a questionnaire study of temperament factors made by Derman, Diran, and Harman. The problem addressed in this study was how to obtain full coverage of a total of 400 items in the temperament questionnaire without requiring all respondents to answer the full set of questions.

In the temperament questionnaire 25 factors comprising 400 items plus a 20 item "desirability" scale were distributed among 30 overlapping booklets, each to be administered to a separate sub-sample of the experimental group being studied. The experimental design required that items representing five of the 25 factors be given to each of the 30 samples, while each factor appeared in six different samples so that comparisons among all factors could be made on a statistically sound sampling basis.

The basic rationale and purpose of the design was to organize the task so that respondents will complete an inventory in a reasonable amount of time, one-half hour to one hour, and still provide reliable data. This goal can be accomplished in task analysis by creating several inventory booklets for an OF, with each booklet containing various overlapping groups of tasks. Appendix A gives technical details of the experimental design and the steps necessary to develop multiple booklets that meet the objective of full coverage of all items when all responses are summed.

D. READABILITY LEVELS OF TASK INVENTORIES VS. THE EDUCATIONAL LEVELS OF MARINE RESPONDENTS.

1. The Hypothesis Tested. The fourth principal hypothesis to be tested suggests that: The wording of the task inventory questions frequently does not match the educational level of the Marine respondent, resulting in a lack of comprehension of the questions.

The most extensive studies in this Research Area involved analyses of the readability of task inventories and measures of reading ability levels of samples of enlisted Marines at three West Coast Marine bases. Readability analyses were conducted on the following OF inventories: 02 (Intelligence); 13 (Construction, Equipment, and Shore Party); 2311 (Ammunition Technician); 2335 (Explosive Ordnance Disposal); 33 (Food Service); 41 (Club, Food Service, Exchange, Base Special Service Officer); 43 (Public Affiars); 46 (Photography); and 67 (Air Control, Anti-Air Warfare). Reading ability measures of samples of enlisted Marines were taken at the Marine Corps Air Station, El Toro, at Camp Pendleton, and at the Marine Corps Recruiting Depot, San Diego.

2. Readability Analysis of Task Inventories. As frequently emphasized, the task inventory questionnaire is the primary instrument for data gathering in Marine Corps task analysis. It is compiled after task analysts have conducted an extensive investigation into an OF in an effort to identify all possible tasks a Marine might perform in his billet. Every effort is made to ensure that no task performed in the OF is left out of the inventory. Unfortunately, completeness of task inclusion does not guarantee that the incumbent will recognize the tasks he performs when he sees them described on the printed page. It is considered essential that all task statements be worded to reflect the tasks performed so that the incumbent can easily read and understand them.

It is assumed that that aim is accomplished when the respondent assigns "meaning to a printed message and completes the act of communication initiated by the writer". [4]

4. Hittleman, Daniel R., Seeking a Psycholinguistic Definition of Readability, THE READING TEACHER, May, 1973, pp. 783-789.

Readability research reported in the literature has predominantly focused on the readability of children's literature. There is little reported material applicable to adults and to instruments such as Task Analysis inventories. Some work has been done in the areas of readability of interest inventories and vocational tests.[5,6] Only one study was found involving an application to job analysis. Ash and Edgell conducted a study to determine the readability levels of the directions and questions for the Position Analysis Questionnaire (PAQ).[7] Many discrepancies were found between the reading levels of PAQ respondents and readability measures of PAQ items. As a means of preventing frustration in attempting to comprehend the test material, these authors endeavored to match the readability levels of the tests to the reading ability of their clients. OMU's task inventories should meet the same criteria. Task statements and instructions should be written at a readability level that will match the reading ability of Marines who are asked to respond to them.

One of the hypotheses in our research was that some Marines, especially those in lower technology OF's, could not read task inventory questionnaires with sufficient comprehension to understand them fully. This hypothesis was tested in three steps. Step one involved measuring the readability of task inventories. This step sought to determine the level of reading ability necessary to understand items in an inventory. Step two involved measuring the reading grade level of a representative sample of Marines. This was done by

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5. Stefflre, Buford, The Reading Difficulty of Interest Inventories, OCCUPATIONS, November, 1947, 26 pp. 95-96.

6. Johnson, Ralph H. and Bond, Guy L., Reading Ease of Commonly Used Tests, JOURNAL OF APPLIED PSYCHOLOGY, 1950, 34, pp. 319-324.

7. Ash, Ronald A., and Edgell, Steven L., A Note on the Readability of the Position Analysis Questionnaire (PAQ), JOURNAL OF APPLIED PSYCHOLOGY, 1975, 60. pp. 765-766.

administering the Gates-MacGinitie Reading Test to a sample of Marines at the three Marine Corps installations mentioned above. Inferences about the general reading level of Marines were drawn from these samples. The third step involved asking Marines who had completed task inventories to express their attitudes toward the questionnaires.

3. The Application of Readability Formulas.

a. The Selection of Formulas to be Tested.

Several readability formulas were applied to measure the difficulty levels of the task inventories listed above. The use of more than one formula was considered necessary in order to verify the results. Originally, four of the more commonly used measures were selected: the Dale-Chall Readability Formula, the Flesch Readability Index, Gunning's FOG Index, and McLaughlin's SMOG Grading. After completing the reading level analysis with these four formulas, an extended search of the literature was conducted. We were rewarded by the discovery of a method specifically designed for use with standardized tests that may have some sections composed of word lists and other sections with short sentences or statements. This measure is the Forbes-Cottle Method for Determining Readability of Standardized Tests. Inasmuch as tasks in task inventories are described by short sentences or statements, this method was deemed to merit special attention. We applied it to the nine inventories, and concluded that the Forbes-Cottle is probably the measure best adapted to determining readability of task inventories. Finally, because task inventories tend to contain many technical words, the FORCAST method, which was developed by the research staff at the Human Resources Research Organization (HumanRRO), specifically to measure Army technical job reading, was applied.

Each of the measures was applied to the inventories according to the instructions prescribed by their developers. Directions given in the task inventory were segregated from the rest of the inventory so that each of these segments received individual analysis. The hypothesis for separately analyzing the instructions and task items is that the variations in structure between the two might result in different levels of reading difficulty.

The sampling scheme utilized was to analyze the instructions in their entirety, while a sample of every third page of the task statements was conducted independently by each of two staff members, thereby analyzing two-thirds of the total task statements. The only exceptions to this sampling technique occurred when using the SMOG index and the Forbes-Cottle formula. The SMOG index was applied to a sample of 30 sentences each from instructions and task statements in accordance with McLaughlin's directions. For the Forbes-Cottle measure, three samples of 100 words each were taken from both instructions and task statements. Appendix B contains expanded sampling instructions as well as school grade level conversion tables for the Dale-Chall, Flesch, and Forbes-Cottle formulas.

B. The Dale-Chall Readability Formula.[8]

The Dale-Chall Readability Formula is based on average sentence length and on the percentage of unfamiliar words not on the Dale-Chall list of 3,000 familiar words. A raw score is computed:

Raw Score = (.0496 x average sentence length) + (.1579 x % of unfamiliar words) + 3.6365.

This raw score is then converted to school grade level by referring to the table of scores and school grades. Table 3 shows a comparison of the school grade reading level for the "instructions" portion of the task inventory as measured by five of the six formulas studied. A similar analysis (Table 4) was made

8. Dale, Edgar, and Chall, Jeanne S., A Formula for Predicting Readability, EDUCATIONAL RESEARCH BULLETIN, January 21, 1948, pp. 11-20, 28.

Table 3

School Grade Level of Task Inventory
INSTRUCTIONS
As Measured by Five Readability Formulas

Task Inventory	Dale-Chall	FOG	SMOG	Flesch	Forbes-Cottle	Average
OF 02, Intelligence	7-8	14.46	10	College	7	10.99
OF 13, Construction	9-10	11.78	10	College	8	11.06
OF 2311 Ammunition Technician	7-8	12.26	9	College	8	10.55
OF 2335, Explosive Ordnance Disposal	7-8	12.26	9	College	8	10.55
OF 33, Food Service	11-12	16.38	11	College	8	12.58
OF 41, Club, Food Service, Base Special Service Officer	9-10	16.39	10	College	8	11.98
OF 43, Public Affairs	11-12	13.04	10	College	9	11.91
OF 46, Photography	9-10	15.59	10	College	8	11.82
OF 67, Air Control, Anti-Air Warfare	9-10	11.71	10	College	8	11.04
Average	9-10	13.78	9.9	College	8	11.39

Table 4

School Grade Level of Task Inventory
STATEMENTS
As Measured by Five Readability Formulas

Task Inventory	Dale-Chall	FOG	SMOG	FLESCH	Forbes-Cottle	Average
OF 02, Intelligence	16	11.26	9	College	College	12.85
OF 13 Construction	16	10.66	8.5	College	College	12.63
OF 2311, Technician	16	11.43	10	College	College	12.49
OF 2335, Explosive Ordnance Disposal	16	13.68	10.5	College	College	13.68
OF 33, Food Service	11-12	11.82	9	College	College	12.16
OF 41, Club, Food Service, Base Special Service Officer	16	17.30	11.5	College	12	14.16
OF 43, Public Affairs	16	14.02	9.5	College	College	13.50
OF 46, Photography	16	10.71	10	College	12	12.54
OF 67, Air Control, Anti-air warfare	13-15	9.92	10	College	11	11.98
Average	15.1-15.4	12.31	9.8	College	12.89	12.89

for the task statement section. Table 3 reveals that the Dale-Chall measure suggests somewhat higher scores than the Forbes-Cottle index, and is substantially lower than the FOG, SMOG, and Flesch levels. (Because Flesch specified "College" as one level rather than specific years, an arbitrary value of 14 was assigned to the "College" level in computing the averages shown in Tables 3 and 4.) Table 4, on the other hand, shows that the Dale-Chall formula produces the highest reading grade levels of the five formulas when used to analyze the task inventory statements. The causes of this variability are discussed in Section 4 below.

c. The Flesch Readability Index.[9]

The Flesch Readability Index is based upon average sentence length and the number of syllables per 100 words. A Reading Ease Score is calculated:

Reading Ease Score = 206.835 - (1.015 x average sentence length) - (.846 x number of syllables per 100 words)

The Reading Ease Score is converted to school grade level by means of a table of scores and grade levels. ("College" is arbitrarily scored as "14".)

According to Tables 3 and 4, both for the task inventory instructions and for the task inventory statements, the Flesch Index results in either the highest or next to highest grade level.

d. Gunning's FOG Index.[10]

Gunning's FOG Index is based upon average sentence length and the percentage of polysyllabic words. The School Grade Level is computed by the formula:

School Grade Level = (Average sentence length + % polysyllabic words x .4)

9. Flesch, Rudolf F., THE ART OF READABLE WRITING, New York: Harper Row Publisher, 1949.

10. Gunning, Robert, THE TECHNIQUE OF CLEAR WRITING (rev. ed.), New York: McGraw-Hill Book Co., 1968.

Table 3 (for instructions) and Table 4 (for statements) show that the FOG Index rates instructions at a higher grade level (an average grade level of 13.78) than for task inventory statements (an average grade level of 12.31).

e. McLaughlin's SMOG Grading.[11]

McLaughlin's SMOG Grading is based upon the number of polysyllabic words in a 30-sentence sample. The School Grade Level is computed by the formula:

School Grade Level = Square root of the number of polysyllabic words in a sample (rounded to nearest perfect square) + 3.0.

Tables 3 and 4 place the SMOG Grading school level at approximately the tenth grade for the task inventory instructions and statements.

f. The Forbes-Cottle Method for Determining Readability of Standardized Tests.[12]

The Forbes-Cottle Method for Determining Readability of Standardized Tests is based upon the selection of words in a sample that have a weight of 4 or more in the THORNDIKE JUNIOR CENTURY DICTIONARY.[13] The formula for computing the Index of Vocabulary Difficulty is:

Index of Vocabulary Difficulty = sum of the weights of the difficult words ÷ number of words in the sample .

The indices thus computed are converted into school grade levels by means of a table of scores.

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11. McLaughlin, G. Harry, SMOG Grading - A New Readability Formula, JOURNAL OF READING, May, 1969, pp. 639-645.

12. Forbes, Fritz W., and Cottle, William C., A New Method For Determining Readability of Standardized Tests, THE JOURNAL OF APPLIED PSYCHOLOGY, Vol. 37, no. 3, 1953, pp. 185-190.

13. Thorndike, E. L., THORNDIKE CENTURY JUNIOR DICTIONARY (rev. ed.) New York: Scott, Foresman and Company, 1942.

Table 3 shows that for instructions, the Forbes-Cottle produces an eighth grade readability level and Table 4, for task inventory statements, approximately a readability level of that of college freshmen.

g. FORCAST Method for Determining Reading Requirements of Military Occupational Specialties.[14]

The FORCAST Method for Determining Reading Requirements of Military Occupational Specialties is based upon a count of the number of one-syllable words in a 150-word passage. The Reading Grade Level is computed by the formula:

$$RGL = 20 - \frac{\text{number of one-syllable words}}{10}$$

Table 5 shows that the mean grade level produced by FORCAST is quite close to the Flesch and Dale-Chall methods with less variability than the latter two.

4. A Comparison of the Results of Formula Applications.

a. Some Causes of Variability.

Tables 3, 4, and 5 reveal that the various formulas result in considerable variability in the indicated reading grade levels required for comprehension of the task inventory questionnaires. Research staff members expressed concern that the user should be aware of the reasons for discrepancies as a help in interpreting these results in relation to the true level of difficulty.

A recurrent warning in much of the reported readability research is: "For one thing, word lists and formulas aren't absolutes -- they don't

14. Caylor, John S. and others, METHODOLOGIES FOR DETERMINING READING REQUIREMENTS OF MILITARY OCCUPATIONAL SPECIALTIES, Technical Report 73-5, Human Resources Organization, March, 1973.

Table 5

Cross-Validation of the FORCAST FORMULA: Means and Intercorrelations Among Four Indexes of Passage Difficulty

Index	INTERCORRELATION				MEAN	SD
	1	2	3	4		
1 FORCAST	-	.98	.95	.77	9.4	2.0
2 Flesch	.98	-	.94	.78	9.4	4.2
3 Dale-Chall	.95	.94	-	.86	9.5	4.0
4 Scaled RGL*	.77	.78	.86	-	10.4	2.2

* RGL = Reading Grade Level

SOURCE: John S. Caylor, Thomas D. Sticht, Lynn C. Fox, and J. Patrick Ford, Methodologies for Determining Reading Requirements of Military Occupational Specialties, HumRRO - Technical Report 73-5. Washington, D.C.: Human Resources Research Organization, March 1973, 17, Table 6.

pretend to be. They are probability statements". [15] Hence grade levels reflected by readability formulas are far from perfect measures; in fact "it is generally accepted that estimates have an error factor of approximately one full grade". [16]

The tables also reflect considerable variation among the results obtained from the different formulas. This finding is by no means unique to our studies. Reported research is filled with similar findings of varying results from the application of different measures of readability. Few analyses in the literature explain why such variations occur. Only one report specifically addressed itself even briefly to this question. The author concluded "that differences among ratings by various formulas are probably not due to sampling errors or the ease or difficulty of the materials tested, but are rather due to such inaccuracies as are inherent in the formulas themselves". [17] Unfortunately, the author does not go on to explain precisely what inaccuracies may be causing the variations nor does he come up with a hypothesis to account for the discrepancies.

Because of the dearth of information about inconsistent results from application of different measures of readability we calculated composite (average) indexes and reviewed the rationale of each index in an attempt to develop a more satisfactory hypothesis of our own.

It appears that much of the discrepancy in estimated reading difficult levels from different formulas can be attributed to different assumptions about the factors in readability held by those who have created those indexes.

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15. Blair, Allen M., Everything You Always Wanted to Know About Readability But Were Afraid to Ask, ELEMENTARY ENGLISH, May, 1971, pp. 442-443.

16. Spache, George D., GOOD READING FOR POOR READERS, Champaign, Garrard Publishing Co., 1970.

17. Klare, George R., Measures of the Readability of Written Communication: An Evaluation, THE JOURNAL OF EDUCATIONAL PSYCHOLOGY, November, 1952, pp. 385-399.

These differences are most evident in the Dale-Chall formula, which is based upon average sentence length and percentage of unfamiliar words (those not included on the Dale-Chall list of 3,000 familiar words).[18] This formula places considerable emphasis on "vocabulary load", which is defined by Flesch as "the stock of words the reader will encounter in a piece of writing".[19]

Three of the formulas do not count unfamiliar words. Instead they use syllable count combined with sentence length as a measure of difficulty. The Forbes-Cottle method assesses word frequency by use of the weightings given in Thorndike's Century Junior Dictionary.[20] Flesch contends that vocabulary load is an unsatisfactory measure of readability because "it is based on outmoded connectionist theory and has been proved unreliable by a growing body of research".[21] Flesch prefers to use syllable count and average sentence length to measure degree of abstractness and difficulty. Gunning and McLaughlin agree that syllable count is an important factor in estimating semantic difficulty but have eliminated the need to count every syllable by substituting a count of words with three or more syllables. Gunning's FOG index is based upon average sentence length and number of words with three or more syllables. Words of three or more syllables are considered to be polysyllabic. McLaughlin's SMOG index is determined by the number of polysyllabic words in a sample of 30 sentences. Hence it appears that the developers' theories regarding the factors which contribute to semantic difficulty and their means for measuring those factors may well be the most important

18. Dale, op. cit.

19. Flesch, Rudolf F., A Dissenting Opinion On Readability, ELEMENTARY ENGLISH, Vol. 26, no. 6, October, 1949, p. 332.

20. See Appendix C for a discussion of the weighting designation used by Thorndike.

21. Flesch, op. cit., p. 333.

source of interformula variation.

Each developer specifies unique methods for applying his principles, thus contributing to further variation in the results. For some formulas, very precise rules have been devised to ensure consistent measurement. In others, many of the guidelines leave great leeway for the user's discretion. The formulas also vary in instructions for handling certain terms. For example, the figure $1,725 is considered a familiar word by the Dale-Chall method and therefore does not increase estimated difficulty. That same figure when evaluated by the Flesch formula, results in a count of 13 syllables (one thou-sand sev-en hun-dred and twen-ty five dol-lars) and can substantially increase the estimated readability level of a sample of written material.

One interesting result of our study is the relationship between the SMOG index and the other formulas -- results from the SMOG (for task inventory statements) are substantially lower than from the other measures. This relationship is exactly the opposite of that reported in most studies. McLaughlin himself states "Comparisons show that SMOG Grades are generally two grades higher than the corrected Dale-Chall levels, which purport to indicate 'the grade at which a book or article can be read with understanding' -- a less severe criterion than the one used here (that of complete comprehension)".[22]

An attempt to reconcile our findings with results reported by others suggests that the sentence fragments which comprise task statements may be a major factor in the unexpected results. Since the SMOG calculation is based upon a specified number of sentences rather than a set sample of words, the very short expressions that are characteristic of task statements in task

22. McLaughlin, S. Harry, Clearing the SMOG, JOURNAL OF READING, December, 1969, pp. 210-211.

analysis inventories yield fewer polysyllabic words per sentence than is found in other types of writing. This causes a lowered SMOG index. At the same time, the technical language results in many unfamiliar words that are not included on the Dale-Chall List, which increases the Dale-Chall score. Thus, it appears that the unique procedures of the inventories has caused rather distinctive scores for the Dale-Chall and SMOG formulas and raises a question as to whether the Fog and Flesch indices are likewise affected.

b. Recommended Use of the Forbes-Cottle Method.

The issue of technical terms inflating estimated reading difficulty levels of the task inventories seems to be most effectively bypassed by the Forbes-Cottle method. The developers of this measure recognize the limitations of other earlier formulas when used with test materials: "The peculiar make-up of the reading matter in standardized tests required that only the vocabulary difficulty factor be used for determining their readability. The use of such factors as sentence length...was not practical since many of the tests have sections composed of word lists". [23]

Difficulty level is determined in the Forbes-Cottle method by totaling the weights of every third word that has a word weight of 4 or more within the sample. A more realistic approach might be to ignore the weightings of common military and/or Military Occupational Specialty (MOS) terms. For example, "billet" has a weight of 12 assigned to it by the Thorndike Century Junior Dictionary, but Marines encounter this word almost daily and probably would not consider it at all difficult. Eliminating such words from the sample would lower estimated difficulty levels and result in a more realistic estimate of vocabulary difficulty.

23. Forbes, op. cit.

Inasmuch as the Forbes-Cottle method was designed specifically for use with questionnaires and tests, it seems probable that it may more realistically measure the actual level of semantic difficulty of task inventories than do the other formulas. It appears to be the most appropriate measure to use in determining readability of task inventories, and this measure also offers the most practical approach to gauging the readability level of inventories. In applying the formula, users need to be aware that individual perceptions can influence which words are chosen as being difficult. Professors Forbes and Cottle discuss the application of the method thus: "Each word that 'appeared' difficult to the grader was written on a sheet of paper".[24]

That sentence suggests a high degree of discretion and subjectivity in selecting the difficult words in each sample. This kind of "open-ended" approach presents a distinct disadvantage in the use of this method. It would be all too easy for task analysts to rationalize that a "difficult" word was one whose definition was unknown to them. Therefore, it is an absolute prerequisite for the task analysts using this method to come to some agreement on a common set of criteria to designate what are "difficult" words.

c. The Potential of the FORCAST Method.

While it is the belief of our research staff members that the use of the Forbes-Cottle method may result in the best measure of school grade level reading difficulty of task inventory questionnaires, we also believe that the FORCAST method may provide a useful supplement. The FORCAST method was developed by the Human Resources Research Organization specifically to measure readability of Army technical job descriptions. "Unlike most general-purpose readability formulas, it was not intended for use with elementary

24. Ibid., p. 189.

school materials, or with newspapers and magazines, and its applicability to these is not demonstrated." [25] Table 5 shows the correlations among this measure and the others that were discussed in earlier paragraphs. The creators of FORCAST also recommend its use over the others because of the simplicity of its application.

d. Conclusions Concerning the Variability of Results.

As hypothesized, some variation exists between the difficulty levels of the task statement and the instructions. However, the direction of the variation is not consistent. One possible explanation (see above) considers the factors stressed by the formula developers. Instructions are rated considerably easier than the task statements for the Dale-Chall formula (9-10 grade level for instructions versus College graduate level for task statements). Since the instructions do not contain a large number of technical words, fewer are rated "unfamiliar" and the difficulty level declines. The FOG and SMOG measures, however, reflect somewhat greater difficulty levels for instructions. Evidently the increased average sentence length in the instructions outweighs any reduction in numbers of polysyllabic words.

With full recognition that the inventory structure and vocabulary tend to highlight weaknesses in the readability formulas, researchers generally caution against relying too heavily on the figures obtained from readability studies. It is recognized that "each formula is really applicable only to the types of reading materials on which it was based". [26] Since the formulas were developed on a rather limited range of materials, application to other forms must be considered with some degree of skepticism. For the moment

25. Caylor, op. cit.

26. Caylor, L. S. and others, Measure Readability...With Salt! EDITORIAL INSTRUCTOR, March, 1975, p. 12.

only the Forbes-Cottle method seems to offer plausible readability applications to testing material.

Perhaps the most convincing argument against accepting any single readability score as a dependable positive indication of semantic difficulty is the lack of precision in identifying factors which influence reading skills. "Put simply, reading is complex. There just aren't ways to measure readability which fully reflect its complexities and subtleties."[27] Factors such as writer style, reader interest and motivation greatly influence readability but defy easy measurement.

Unfortunately, because of the many inconsistencies, differences, and built-in limitations of the various readability indexes, it is hazardous to draw precise conclusions about the readability of Task Analysis inventories. Our findings clearly suggest, however, that their readability levels may be well above the reading ability of the average Marine. As a result, administration of such an inventory may not provide reliable information. That conclusion is supported by our studies of reading ability among Marines.

5. Measuring the Reading Ability of Marines.

a. Use of the Gates-MacGinitie Reading Test.

In the preceding section the necessary reading level required for an individual to understand successfully the task inventory was discussed. A number of inventories were found to be written at a level indicating that completion of education through at least the tenth grade, and in some cases through the twelfth grade, or high school, would be needed if a Marine were to read the inventories with adequate understanding.

The purpose of the testing of reading levels of enlisted Marines

27. Spache, George D., GOOD READING FOR POOR READERS, Champaign, Illinois: Garrard Publishing Company, p. 12, 1970.

was to determine what proportions of Marines in different pay grades and different occupational fields (OFs) possess reading abilities that are adequate to comprehend the inventories they are required to complete. Results are in the direction that might be expected. The majority of Marines in the higher pay grades (E6 through E9) have reading comprehension ability at levels indicating they should be able to read and understand most task analysis inventories with little difficulty. And Marines in the higher technology OFs, on the average, reflect higher levels of reading ability than those who have an MOS in one of the lower technology OFs.

The Gates-MacGinitie Reading Tests (Level D) were administered in this study. These tests provide objective measures of how rapidly a person reads, how accurately he reads at that speed, as well as his vocabulary knowledge and reading comprehension. As a single measure, the Comprehension Test provides the best estimate of ability to read complete prose passages with understanding. This test is regularly used to measure the reading ability of new recruits at MCRD, San Diego. It is also the only reading test that is administered at the Recruit Depot.

Test results are reported in Tables 6 through 10 in this report in terms of "school grade scores". The range of scores is from elementary school grade 2.1 through high school grade 11.9 on the Comprehension Test and from grade 2.0 to 12.0 on the other tests. These are the ranges specified by the test publisher in the test manual.

Tables 6 and 7 show the reading comprehension levels of the samples at MCRD, San Diego, and Camp Pendleton, respectively. It is assumed that at these installations there is a composite of low and high technology OFs. The reading comprehension grade levels appear to support this expectation

Table 6

Reading Comprehension of Random Sample of Permanent Enlisted Staff Personnel Assigned to MCRD, San Diego

Gates-MacGinitie Reading Test, Level D

School Grade Level	Distribution by Pay Grade and School Grade Reading Level								
	E-1	E-2	E-3	E-4	E-5	E-6	E-7	E-8	E-9
11.9+	7	14	14	14	18	20	16	20	12
11.9	1	4		1	5	2	6	2	2
10.9	2		3	1	1	1	4	1	
9.9	1	1	2		1	3	4	3	3
9.3	3	1	3			2	1		1
8.7									
8.1		3		3	4				1
7.6	1		1		1	1		1	
7.2									
6.8	1							1	
6.5	1		1						
6.2	1		1						
6.0									
5.8			1	1					
5.6					1				
5.5				1					
5.3	1		1				1		
5.2									
5.0		1			1				
4.9									
4.8	1								
4.7		1							
4.6	1		1						
4.5	2								
3.5	1								
3.1				1					
2.2					1				
	N=24	N=25	N=28	N=22	N=33	N=29	N=32	N=28	N=19
Average	8.7	10.8	10.1	10.4	10.5	11.3	11.2	11.3	11.2

Overall Average School Grade Level = 10.6

Total N = 240

Table 7

Reading Comprehension of Random Sample of Permanent Enlisted Personnel Assigned to Camp Pendleton

Gates-MacGinitie Reading Test, Level D

School Grade Level	Distribution by Pay Grade and School Grade Reading Level								
	E-1	E-2	E-3	E-4	E-5	E-6	E-7	E-8	E-9
11.9+	11	46	28	18	13	2	1		
11.9	1	8	7	1					
10.9	4	7	7	2	4				
9.9	2	5	4		3				
9.3	3	13	5	4					
8.7	3	11	1						
8.1	1	10	3	1					
7.6	1	4	2	2		1			
7.2	1	10	2	2					
6.8		4	2						
6.5	4	4	1	3					
6.2	1	3							
6.0	3	1	1						
5.8		5	1		1				
5.6		5	1	1					
5.5		1	1	3					
5.3		2	2						
5.2		3		1					
5.0		3							
4.9	2	3				1			
4.8	2	3	2						
4.7		1	1						
4.6	2	2	1						
4.5		2	1	1					
4.4		5	1						
4.2									
4.1	2								
4.0		3							
3.9									
3.8	2	2			1				
3.7									
3.5	4								
3.4		1							
3.3			1						
3.2	1	1							
3.1		1							
3.0		1			1				
2.9	1	1							
2.7		1							
2.6	1								
2.5				1					
2.4	1								
2.3									
2.2									
2.1		1		1					
	N=55	N=173	N=75	N=41	N=23	N=4	N=1	N=0	N=0
Average	7.5	8.5	9.7	9.2	10.5	9.2	11.9+		

Overall Average School Grade Level = 8.8

Total N = 372

Table 8

Reading Comprehension of Random Sample of Permanent Enlisted Personnel Assigned to MCAS, El Toro

Gates-MacGinitie Reading Test, Level D

School Grade Level	Distribution by Pay Grade and School Grade Reading Level								
	E-1	E-2	E-3	E-4	E-5	E-6	E-7	E-8	E-9
11.9+	9	11	22	13	21	23	21	19	9
11.9	2	3	3	5	4	4	2	4	2
10.9	1	3	2	2	2	1	1	1	1
9.9	1	1	1	6			1		
9.3	1	2	1						
8.7	1	1							1
8.1		2	1		1				
7.6	1	1							1
7.2	1								
6.8									
6.5	1								
6.2				1					
6.0									
5.8									
5.6									
5.5							1		
5.3									
5.2									
5.0							1		
	N=18	N=24	N=30	N=27	N=28	N=28	N=27	N=24	N=14
Average	10.6	10.8	11.6	11.2	11.7	11.9	11.3	11.9	11.3

Overall Average School Grade Level = 11.4
Total N = 220

Table 9

Reading Comprehension of Random Sample of Permanent Enlisted Personnel at Three Southern California Installations -- According to Years of Schooling Completed

Gates-MacGinitie Reading Test, Level D

Average School Grade Level of Reading Comprehension

	MCRD, San Diego		Camp Pendleton		MCAS, El Toro		Composite Average	
	N	Average Grade Level	N	Average Grade Level	N	Average Grade Level	N	Average Grade Level
Years of Schooling Completed								
Less than 12	73	10.4	188	8.6	75	10.9	336	10.0
12	131	10.5	164	9.9	122	11.4	417	10.6
More than 12	36	11.0	16	11.0	23	11.9	75	11.3
TOTAL	240	10.6	368	8.8	220	11.4	828	10.6

Table 10

Reading Comprehension of Random Sample of Permanent Enlisted Personnel at Three Southern California Installations -- According to Geographic Area of Schooling

Gates-MacGinitie Reading Test, Level D

Average School Grade Level of Reading Comprehension

	MCRD, San Diego		Camp Pendleton		MCAS, El Toro		Composite Average	
	N	Average Grade Level	N	Average Grade Level	N	Average Grade Level	N	Average Grade Level
Northeast	27	11.7	37	10.2	38	11.5	102	11.1
North Central	77	10.9	119	9.5	55	11.5	251	10.6
South	62	9.3	97	9.9	68	11.4	227	10.2
West	68	11.1	107	8.6	57	11.5	232	10.4
Other≠	3	10.4	8	6.7	2	11.9	13	9.7
TOTAL	237	10.7	368	8.9	220	11.6	825	10.4

≠ Guam, Japan, American Samoa, Canada, Philippines, Okinawa

since there is a considerable scattering among the lower grades. At MCRD, San Diego, the low was grade 2.2 and at Camp Pendleton, grade 2.1. At MCAS, El Toro, on the other hand, the expectation would be to find primarily high technology OFs. Table 8 appears to confirm this expectation, with the lowest grade-level recorded being 5.0. Tables 6 through 8 also tend to confirm the expectation that Marines in the higher pay grades are capable of higher reading comprehension.

Table 9 appears to indicate that the permanent enlisted Marines assigned to the more general duties at Camp Pendleton have a lower average reading comprehension than do those assigned to the more specialized duties of MCRD, San Diego, and MCAS, El Toro.

Table 10 appears to indicate that Marines recruited from the south and assigned to the less technical functions of MCRD, San Diego, and Camp Pendleton, represent a lower average level of reading comprehension than those recruited from other sections of the continental United States. However, those presumably in the higher technology OFs of MCAS, El Toro, have comparably high levels of reading comprehension irrespective of the section of the U. S. in which they received their schooling.

The data of Tables 6 through 10 indicate that, as was hypothesized, average levels of reading ability of Marines are not well-matched to the measured readability levels of task inventory booklets. As a result, data provided by respondents may be questionable, if not actually erroneous. This mis-match may generate critical respondent reactions -- including carelessness, frustration, and a minimum of enthusiastic cooperation -- among Marines who are required to complete these inventory booklets.

b. Other Factors in the Reading Ability of Marines.

In analyzing the data acquired throughout this research, an attempt was made to pinpoint and determine certain trends that exist in the reading ability of Marines.

As the Readability section indicated, the inventories give evidence of requiring a relatively high level of reading ability for full comprehension. In subsequent discussions with OMU personnel the accuracy of this conclusion was questioned. Their argument was that a Marine in his OF is highly conversant with the technical terms in his field because of previous training and preparation in his area of experience. Nevertheless, it is the opinion of the research staff that there is a difference between audible comprehension and that facet of comprehension which results from reading the printed page.

In an effort to ascertain to some degree the dimensions of the problem, a test to measure the recognition of technical terms like organoleptic, sprague unit, viscosity, perimeter, etc. was constructed. Unfortunately, development of the test was delayed and we were not able to field test it in time to report any conclusions. However, it is recommended that OMU construct and administer such an instrument. The format of such a "Term-recognition" instrument is essentially that of a matching test, with the words to be identified listed and numbered along the left-hand side of the page and the definitions -- in non-corresponding order -- spelled out on the right-hand side of the same page. Respondents are asked to match the terms with their correct definitions. Numbers of correct identifications score degrees of respondent recognition of these terms.

On the basis of our studies of the reading ability of Marines and

readability of inventory instructions and items, it seems very clear that making task inventories easy to read has to be a matter of high priority for those who are assigned responsibility for constructing these materials. The effort that goes into composing a complete list of task items will be wasted if the intended respondent fails to understand them.

It is important to realize that there is a real problem of low reading ability among the general population of the United States. The trends prevalent in the civilian population are bound to permeate the rank and file of military organizations at some juncture in time. In 1966, the Department of Defense instituted Project 100,000, which allowed 100,000 volunteers who were not previously qualified for admission to the armed forces to enlist. [28] With this reduction in standards, it appears probable that an increased number of future recruits will be deficient in basic reading skills.

Faced with this contingency, the Marine Corps has already taken steps to alleviate this deficiency. A remedial reading program has been established at the MCRD in San Diego, California, for recruits who score less than a grade level of 4.5 on two alternate reading tests. [29] Thus, 4.5 is the minimum reading level acceptable to the Marine Corps. The Army and Navy require an ability to read at the 6th grade level, while the Air Force requires its recruits to read at a level of the 9th grade. [30]

After our staff administered reading tests at three Southern California Marine Corps bases, it was determined that the average reading level for the sample of Marines tested was approximately a grade level of 10.6, with, however, a large degree of variation both above and below that average.

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28. Midway Adult School, San Diego, Cal., PHASE II PILOT RECRUIT REMEDIAL READING PROGRAM, FINAL REPORT OF, p. 1.

29. Ibid., p. 5.

30. Ibid., p. 18.

6. The Attitude of Marine Respondents to Task Inventory Questionnaires. Step three in testing the hypothesis that reading level difficulty of the task inventory questionnaires does not match the reading level ability of the Marine respondents required an attitude survey to determine precisely how Marine respondents reacted to the questionnaires. The attitude survey questionnaire as developed by our research staff members has been included as Appendix D.

The occupational fields to which surveys were administered are:

OF 02 (Intelligence-Officers)

OF 44 (Legal Services)

OF 57 (Nuclear, Biological, Chemical)

Survey results and the Ns involved are shown in Table 11.

The attitude survey was constructed by research staff members in an attempt to obtain first-hand data regarding the attitudes Marines held after completing the task inventories. It sought to find whether the Marines answering the inventories would concur with our hypothesis that the instrument was difficult to read and objectionably long. Unfortunately, the samples obtained were too small to justify conclusive findings. Because of this constraint, recommendations based upon the results of the survey would be questionable. Therefore, we have not attempted to make recommendations. It was unfortunate that the scheduled inventory administrations for low technology OFs did not coincide with the period in which the attitude surveys were conducted. As a result, it was not possible to survey the reactions of Marines in lower technology jobs. This was particularly unfortunate in view of the fact that serious difficulty in comprehending inventory instructions and items is presumably more common within this segment of the Marine population.

TABLE 11

MEAN SCORES ON THE
ATTITUDE SURVEY

SURVEY QUESTIONS	OCCUPATIONAL FIELDS 02 INTELLIGENCE OFFICERS $\bar{X}$	44 LEGAL SERVICES $\bar{X}$	57 NUCLEAR, BIOLOGICAL, CHEMICAL $\bar{X}$
1. I found it interesting to take.	2.4	2.5	2.2
2. I found it easy to get through.	1.9	2.0	2.3
3. It was easy to read.	1.7	1.8	2.7
4. The inventory was too long.	4.0	4.2	4.1
5. I was able to find all the tasks I do.	3.3	3.2	3.1
6. The words used in the task statements were the words I use on the job.	2.8	2.8	3.0
7. The instructions were easy to follow.	1.8	1.8	1.9
8. I found many words I didn't know.	5.8	5.4	5.8
9. I'm glad I had the chance to say what I do in my MOS.	2.4	2.3	2.0
	N=33	N=118	N=59

SCALE DESIGNATION

1. Strongly Agree
2. Agree
3. Somewhat Agree
4. Neither Agree no Disagree
5. Somewhat Disagree
6. Disagree
7. Strongly Disagree

Nevertheless, we believe the survey to be a convenient device for sampling opinions regarding the inventory, a check which should be used regularly by OMU for this purpose.

The attitude survey covered more areas than reading comprehension. Survey questions 3, 6, 7, and 8 are directly relevant to reading ease and lengths. These questions had mean scores of 1.7, 2.9, 1.8, and 5.4, respectively. Thus, the Marine respondents agreed that the questionnaires were easy to read; "somewhat agreed" that the words used in the task statements were the same as the words used on the job; agreed that the instructions were easy to follow; and insisted that they did not find many words that they did not know. These results are those that would be anticipated from the high technology areas and the high pay grades of the Marines sampled.

7. Recommendations on Improving Task Inventory Statement Readability. It is imperative that the inventory be as effective and efficient as possible, with most incumbents responding to it with a minimum of fatigue and frustration.

An instrument of such importance should be written as clearly as possible. Review of the literature and research in this area indicates the following steps as aids to writing that minimize reading difficulty.[31]

1. Avoid words that are unusual.
2. Avoid long words and "shop talk".
3. Use concrete rather than abstract words.
4. Avoid technical language.
5. Use forceful and vivid words.
6. Use strong nouns and verbs.

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31. Pinnie, Anthony F., Telling It Like It Is, SCHOOL AND COMMUNITY, January, 1969, p. 32.

7. Avoid figurative language.
8. Use short, simple sentences.
9. Use short paragraphs.
10. Begin sentences with main idea in main clause.
11. Point out purpose and main theme early.
12. Use active rather than passive voice.
13. Avoid writing slanted toward a particular audience.
14. What does audience know? What do they need to know? How can I best tell them?
15. When I said what I had to say, did I stop?

These fifteen guidelines serve as an introduction to the type of steps to take to produce clearer writing. Another important suggestion is to keep the intended audience firmly in mind when preparing the wording of task items. Put another way, "writers must have vocabularies and ideas in common with their audience". [32]

Keeping technical language to a minimum will also help to lower reading level, however, some technical terms may also be familiar terms for many incumbents, so it is best left to the discretion of the task analysts to determine the acceptability of technical terms. For this purpose, it may be desirable to offer the list of task items to Marines randomly selected from the OF under study to enlist their opinion as to whether the terms are the actual words used for the task out in the field.

The inventory constructor has a tough job on his hands. He has the responsibility of seeing to it that task items are accurate and stated in familiar terms that suggest plain talk. An observing human factors engineer

32. Dale, Edgar and Hager, Hilda, How to Write to be Understood, EDUCATIONAL RESEARCH BULLETIN, November, 1948, pp. 207-216.

had the following to say about profound and technical language. "There's a curious superstition prevalent about technical writing. Many people believe that difficult or obscure writing is the mark of a learned man. In actual fact the reverse is true. Anyone can be obscure and incoherent. This takes no effort whatsoever. But, to write technical material simply -- that takes real skill!" [33]

This should serve as warning to the task item writer to scrutinize the manner in which tasks are stated. The more familiar the writer is with the subject, the more capable he will be in describing the tasks as simply as possible.

All this has served as a general introduction to writing at a lower reading level, but the task inventory constructor has a more specialized requirement. Murphy discusses what can be done to prepare task statements with a more acceptable reading level and presents a set of rules that are listed below: [34]

A. Objective rules

1. Reduce total word value per task statement.
2. Reduce average word value per task statement.
3. Reduce the number of syllables per word.
4. Reduce the number of syllables per task statement.
5. Use double conjunction "and/or" to replace the conjunction "and" when a task statement is composed of parts which may be performed independently. [35]

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33. Chapanis, Alphonse, Words, Words, Words, HUMAN FACTORS, February, 1965. p. 4.

34. Murphy, Walter F., THE APPLICATION OF READABILITY PRINCIPLES TO THE WRITING OF TASK STATEMENTS: EFFECTS ON READABILITY OF JOB INCUMBENT RESPONSES, Unpublished Ph.D. thesis, Purdue University, 1966, pp. 58-59.

35. While Murphy recommends the "and/or" form, the Technical Procedures Guide (op. cit., p. 22) advises against such use.

6. Do not use technical terminology where the range of incumbents' experience may vary greatly.

7. Have all rewritten statements reviewed by job experts for proper interpretation and meaning.

B. Subjective rules

8. Wording of a task should not be so specific as to include the recipient of work performed.

9. Task statements which appear to be very general should be rewritten in a manner which confines the task to the total job context.

The following examples illustrate how the rules are applied.

Rule 1. Reduce total word value per task statement.

Original. Develop cost and pricing required to establish and effect procurement support. Total word value 38.

Rewritten. Develop procurement cost and pricing policies. Total word value 29.

Rule 2. Reduce average word value per statement.

Original. Supervise the application of equitable and uniform pricing policies among contractors. Average word value 4.36.

Rewritten. Supervise the application of fair and equal contract pricing policies. Average word value 2.6.

Rule 3. Reduce the number of syllables per word.

Both examples cited above also demonstrate this requirement.

Rule 4. Reduce the number of syllables per task statement.

Both examples cited above also demonstrate this requirement.

Rule 5. Use double conjunction "and/or" to replace "and" when a task is composed of parts which may be performed independently.

Original. Review complaints and action requests submitted by subordinate units.

Rewritten. Review complaints and/or requests for action from lower level units.

Rule 6. Do not use technical terminology where the range of incumbents' experience may vary greatly.

Original. Conduct contract redeterminations.

Rewritten. Conduct meetings and/or reviews to change contract requirements.

Rule 7. Wording a task should not be so specific as to include the recipient of the work performed.

Original. Prepare reports on all litigation involving the contractor for the Office of the Judge Advocate General.

Rewritten. Prepare reports on legal disputes involving contractors.

Rule 8. Task statements which appear to be very general should be rewritten in a manner which confines the task to the total job.

Original. Conduct surveys of industrial production methods. (Note: It would be a rare individual who could do this without assistance. It is more probable that one may preside as chairman or assist as a member of a group in doing this.)

Rewritten. Conduct or assist in reviews of production methods used in industry.

At best, the rewording of noun phrases is a difficult task. Fortunately, the verb portion of the task item is more amenable to substitution. Sources of substitutes for verbs may be found in an established thesaurus like Roget's or in an Activity Verb List, as well as the Glossary of Action Verbs Used in Naval Occupational Analysis.

There is significant value in using an Activity Verb List. It defines verbs so that they delineate significant distinctions among actions or activities. "With the activity verb list at hand, the analyst has before him a standardized, classified, and indexed vocabulary." [36] (See APPENDIX F.)

In writing task items the constructor should be careful to choose verbs that convey the precise action he intends to describe. The word "assist" may be used as an example. In the American Heritage Dictionary it is defined as "an act of giving aid". [37] The fuller definition in the Activity Verb List is "to give support or aid especially in some undertaking or effort: aid". The fuller definition provided in the List will help the constructor to give a precise description of the task. The arrangement of the List is also valuable in that there are sub-groups of words similiar to the main heading. "Assist" would be found under the main heading of Serving, with subdivisions of assist, attend, and supply. Such distinct demarcation of duties performed could aid the respondent to recognize his tasks clearly.

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36. Stone, C. Harold, and Yoder, Dale, JOB ANALYSIS, 1970,(Ibid.).

37. Davies, Peter, ed., AMERICAN HERITAGE DICTIONARY, New York: Dell Publishing Company, Inc., 1973.

VI

CONCLUSIONS AND RECOMMENDATIONS

This report describes research designed to evaluate task analysis inventories as OMU's principal source of basic data in the OMU Task Analysis program. The major questions raised by the research staff were:

(1) What are the major strengths and limitations of these inventories as they have been developed and used to play a key role in the Task Analysis procedure?

(2) How can their effectiveness and contribution -- and the quality of the data they provide -- be improved?

For answers to these questions, research staff members directed their attention to the characteristics of the questionnaires or booklets with which OMU solicits and collects responses that identify in detail what Marines in the OFs under study actually do in performing their day-by-day assignments. A careful review of current practices and of the literature published by the Marine Corps and other defense agencies revealed the existence of a number of problem areas. Intensive search for possible solutions and improvements in existing practice has appeared to justify a number of conclusions. The resulting recommendations for improvement which are presented in this report should, if adopted, markedly increase the effectiveness and contribution of the task inventory questionnaire in OMU's Task Analysis program.

Research staff members used a wide variety of research techniques to explore problem areas and to discover and formulate potentially promising changes. In addition to the critical review of existing practices and the study of current relevant literature, techniques include the administration

of both standardized and specially developed tests in the field, and statistical analysis of significant variables.

The following is a concise summary of the major problem areas, research findings and results, and recommendations for future practice.

Task Statement Collection. A first step in the construction of the task inventory questionnaire is collection of task statements. The objective is to develop a bank of statements so broad and inclusive that it covers all tasks performed in the OF under study. The number of statements in each questionnaire has ranged from a minimum of 200 to a maximum of 1,000, with an absolute limit of 2,000 based upon the capacity of the computer program (CODAP) used for analysis of inventory responses.

The basic method of discovering tasks to be included in a task inventory is the observation and interview method. This method is effective but it is also time-consuming and costly. It requires a task analysis team to visit areas wherever the work is performed, to observe the performance of Marines in their assigned duties, and to interview OF members concerning their activities. This process typically results in a long and inclusive list of task statements.

Research staff members suspected that task statements could be collected without expending the large amount of time and money involved in transporting task analysis teams to all of the work areas under study. As a result of our research, OMU developed a procedure which is called "Document Research" method. Task statements are derived by studying existing publications and other documents, such as training manuals, service school textbooks, manufacturers' instruction sheets, etc. These are reviewed with "experts" in the OF and are then validated and supplemented by the O&I method. This preliminary preparation of statements greatly speeded up the O&I process and saved time and costs.

We have concluded that the best method for obtaining accurate and complete data for building a task inventory appears to be: (1) thorough review of all available background data in written materials describing duties in an OF, supplemented by interviews with "experts", (2) preparing preliminary task statements based upon this information, and (3) conducting observation and interview visits to field installations to validate or correct these items and to search out tasks not revealed in preliminary reviews.

Question and Answer Booklets. After a task inventory questionnaire is constructed, it must be administered to Marine respondents who provide the required answers. The physical means used to record the answers has an influence on the accuracy and dependability of these responses.

At the time the study began, a two-booklet format was in use. One booklet contained the task statements, and the second booklet provided spaces for the answers, which consisted of marks to be read by an optical scanner as input to the computer. Two problems resulted from this format. First, the transfer of the Marine's attention from the statement booklet to the answer booklet introduced inaccuracies in the responses. Second, the respondent tended to make irrelevant marks in the answer booklets, marks which could be read as responses by the optical scanner. As long as the two-booklet format was used, little could be done about the first problem. To resolve the second problem, the task analysis team had to erase all irrelevant marks -- a time-consuming, costly process.

The OMU staff investigated a variety of possible booklet formats, and recommended the adoption (a recommentation with which we concurred) of the Westinghouse W2300 optical scanning system. This recommendation was not implemented because of the high capital cost of the necessary new equipment. OMU then developed a single-booklet format wherein the response space is

located alongside the task statement. Responses are then transferred to computer storage by the key-to-disk method. This revision has been used and has proved to not only be highly satisfactory, but it has saved time and money and has improved accuracy in both the marking by respondents and in processing the data.

Task Statement Sequencing. Analysis has indicated that the sequencing of the task statements in the task inventory questionnaire can influence the validity of responses -- that is, the answer to one statement may influence the answer to another statement if the two statements are presented near each other.

A variety of sequencing arrangements has been used, including complete randomization, organization by duty areas, and alphabetical listing of tasks.

As a desirable substitute, we developed and recommend a sequencing procedure in which the OFs under study are categorized as to being hardware or software and specialized or generalized. Complex OFs may require items in all four categories. Within each category, task statements are arranged in a randomized order. At the time of this report, the method has not been field tested, but further experimentation is recommended.

Task Inventory Length. In order to cover each entire OF, from 200 to 1,000 task statements have been prepared. Such a lengthy questionnaire may require from three to four hours response time. Authorities on the subject have found that response time on comparable questionnaires should usually be limited to from one-half hour to one hour. Longer response times, they have found, result in inaccuracies traceable to fatigue and boredom.

The research staff has investigated and recommended a technique whereby such a long inventory can be broken up into a number of mini-booklets. Each mini-booklet contains an equal portion of the total questionnaire and all sections include overlapping task statements. The effect of the overlap is

to permit all responses to be summed and then subjected to standard statistical analyses. Thus each Marine respondent answers one mini-booklet, while the entire set of booklets is administered to the total group of Marines.

Identification of Respondents. Part IV of the task inventory questionnaire deals with job satisfaction/dissatisfaction. Because many of the questions pertain to relations with supervisors and co-workers, it was hypothesized that the Marine's knowledge that he could be personally identified with his responses could result in guarded, invalid responses.

At our request, a questionnaire was administered to two groups of Marines completing inventories, one group being required to fill-in identifying information, and the other group remaining anonymous. Analysis disclosed no significant difference between the two sets of responses for any of the questions that research staff members considered to be most likely to be subject to bias. We therefore recommend that Marine respondents continue to fill-in the identifying information.

Reading Ability vs. Readability. No matter how complete a task inventory questionnaire is, responses will be of dubious dependability if Marine respondents cannot read and understand the task statements with full comprehension. It was decided, therefore, to measure both the reading ability of Marine respondents and the reading-level required by task statements and instructions. If the reading-level required by the questionnaire is above the reading ability of the respondents, responses are of doubtful value.

We administered the Gates-MacGinitie Reading Test to three samples of Marines. Individual reading abilities ranged from school grade 2.1 through 12. These samples indicated that in the higher technology OFs and in the

higher pay grades, reading levels tended to be at the upper end of the school grade scale.

Measurement of the readability of questionnaires turned out to be more complex. Unfortunately, results from the application of several scales proved to be inconsistent both as among the various tests and within a single test when applied separately to questionnaire instructions and task statements. Research staff members selected the Forbes-Cottle Method for Determining Readability of Standardized Tests as being the most appropriate for testing task inventory questionnaires. Application of the Forbes-Cottle method revealed that the reading level required for these questionnaires ranged from the 10th to 12th grades.

If these measures are accepted, then clearly Marine respondents whose reading levels are below grade 10 would have difficulty in understanding the questionnaires.

As a means of inproving the readability of questionnaires, two recommendations are included in this report. First, a set of rules for the improved wording of task statements is included in the body of the report. Second, an activity verb list for use in preparing items is included in Appendix F.

Attitudes of Marine Respondents. Concern was expressed that Marine respondents may develop a negative attitude toward answering the task inventory questionnaires because of their length or difficulty. To ascertain the attitudes of respondents, research staff members devised and administered an attitude survey to several groups of respondents. There was little evidence from that survey that supports the hypothesis that respondents actually develop negative attitudes. Research staff members conclude that adoption of the recommendations outlined in this report will further improve the attitudes

of respondents. Nevertheless, hazards are so significant that we recommend that OMU use such an attitude survey regularly to detect the emergence of negative or unfavorable reactions among respondents.

Supplementary Aids Included. The text of this report is supplemented by an annotated bibliography on the measurement of readability as well as by a more extensive general bibliography relevant to the broader range of questions raised throughout the entire research area covered by this report.

As another potentially helpful addition to the test, a series of six appendices details instructions for preparing mini-booklets, specifies the basic formulas underlying each of the six readability indexes discussed in the text, explains the Thorndike system of establishing word-frequency weights, tabulates the attitudes expressed by Marine respondents after their completion of traditional task inventory booklets, and provides two word lists, (1) the Dale list of familiar words, and (2) an activity verb list.

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APPENDIX A

INSTRUCTIONS FOR PREPARING MINI-BOOKLETS

APPENDIX A

INSTRUCTIONS FOR PREPARING MINI-BOOKLETS*

Purpose: To permit Marine Respondents to task inventory questionnaires to respond to a reduced number of task statements.

Background: Under traditional procedures, the Marine respondent to task inventory questionnaires must respond to all task statements that may range from as low as 200 to as many as 1000 items. The mini-booklet procedure permits the Marine respondent to respond to a reduced number of task statements, the number depending upon the number of mini-booklets chosen by the Task Analyst. Thus the time required to complete the inventory is greatly reduced. This should reduce any effects of tediousness, disaffection, inattention, response sets, or other forms of malingering that are related to the length of the questionnaire.

PROCEDURES

Booklet Preparation

Procedures are supplied for splitting the task inventory questionnaire into 6, 10, 15, or 30 booklets.

1. Procedures for 6 booklets:

   a. Divide the total set of task statements into 4 equally-sized groups.

   b. Number the groups 1 through 4.

   c. Assign the groups to the 6 booklets according to Figure 1.

   d. Thus, group 1 will become part of booklets 1, 2, and 3; group 2, part of booklets 1, 4, and 5; etc.

   e. As a result of this assignment, each booklet will be made up from 2 groups, and no booklet will contain the same 2 groups.

   f. N per task statement = .5 x the total number of respondents; that is, the number of respondents per task statement = 50% of the total number of respondents.

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* Based partly upon Dermen, Diran; French, John W.; and Harman, Harry H., VERIFICATION OF SELF-REPORT TEMPERAMENT FACTORS, December, 1974, Technical Report No. 6, Research Sponsored by the Office of Naval Research.

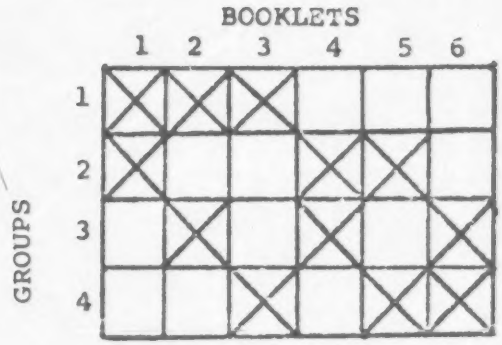

Fig. 1: Four Groups Distributed in Six Booklets

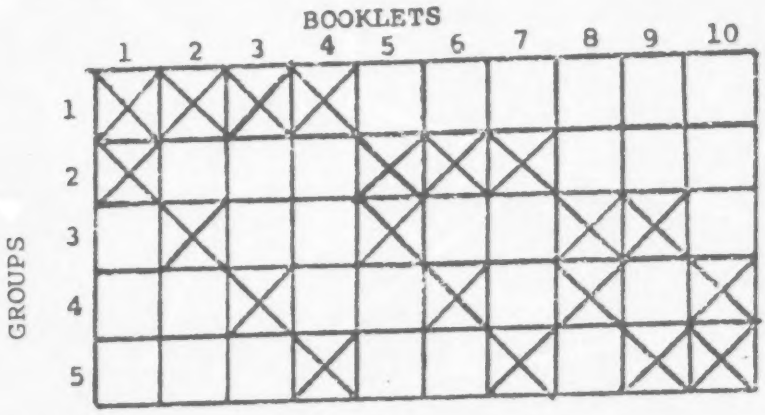

Fig. 2: Five Groups Distributed in Ten Booklets

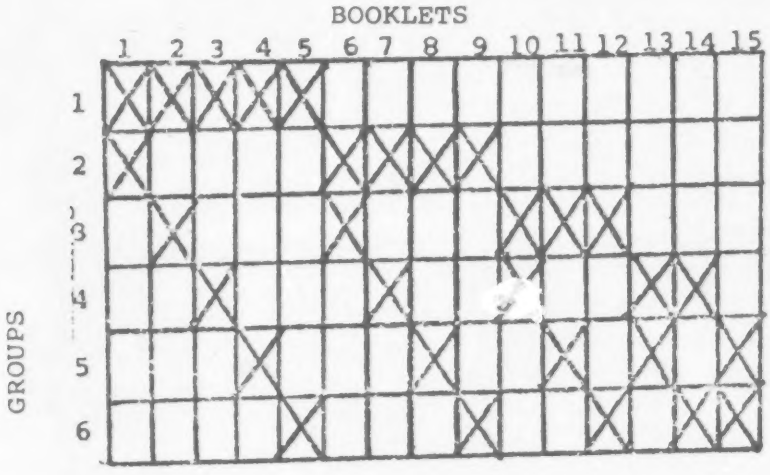

Fig. 3: Six Groups Distributed in Fifteen Booklets

2. Procedures for 10 booklets:

   a. Divide the total set of task statements into 5 equally-sized groups.

   b. Number the groups 1 through 5.

   c. Assign the groups to the 10 booklets according to Figure 2.

   d. Thus, group 1 will become part of booklets 1, 2, 3, and 4; group 2, part of booklets 1, 5, 6, and 7; etc.

   e. As a result of this assignment, each booklet will be made up from 2 groups, and no booklet will contain the same 2 groups.

   f. N per task statement = .4 x total number of respondents; that is, the number of respondents per task statement = 40% of the total number of respondents.

3. Procedures for 15 booklets:

   a. Divide the total set of task statements into 6 equally-sized groups.

   b. Number the groups 1 through 6.

   c. Assign the groups to the 15 booklets according to Figure 3.

   d. Thus, group 1 will become part of booklets 1, 2, 3, 4, and 5; group 2, part of booklets 1, 6, 7, 8, and 9; etc.

   e. As a result of this assignment, each booklet will be made up of 2 groups of task statements and no booklet will contain the same 2 groups.

   f. N per task statement = .333 x total number of respondents; that is, the number of respondents per task statement = 33 1/3% of the total number of respondents.

4. Procedures for 30 booklets:

   a. Divide the total set of task statements into 25 equally-sized groups.

   b. Number the groups 1 through 25.

   c. Assign the groups to the 30 booklets according to Figure 4.

   d. Thus, group 1 will become part of booklets 1, 2, 3, 4, 5, and 6; group 2, part of booklets 1, 7, 8, 9, 10, and 11; etc.

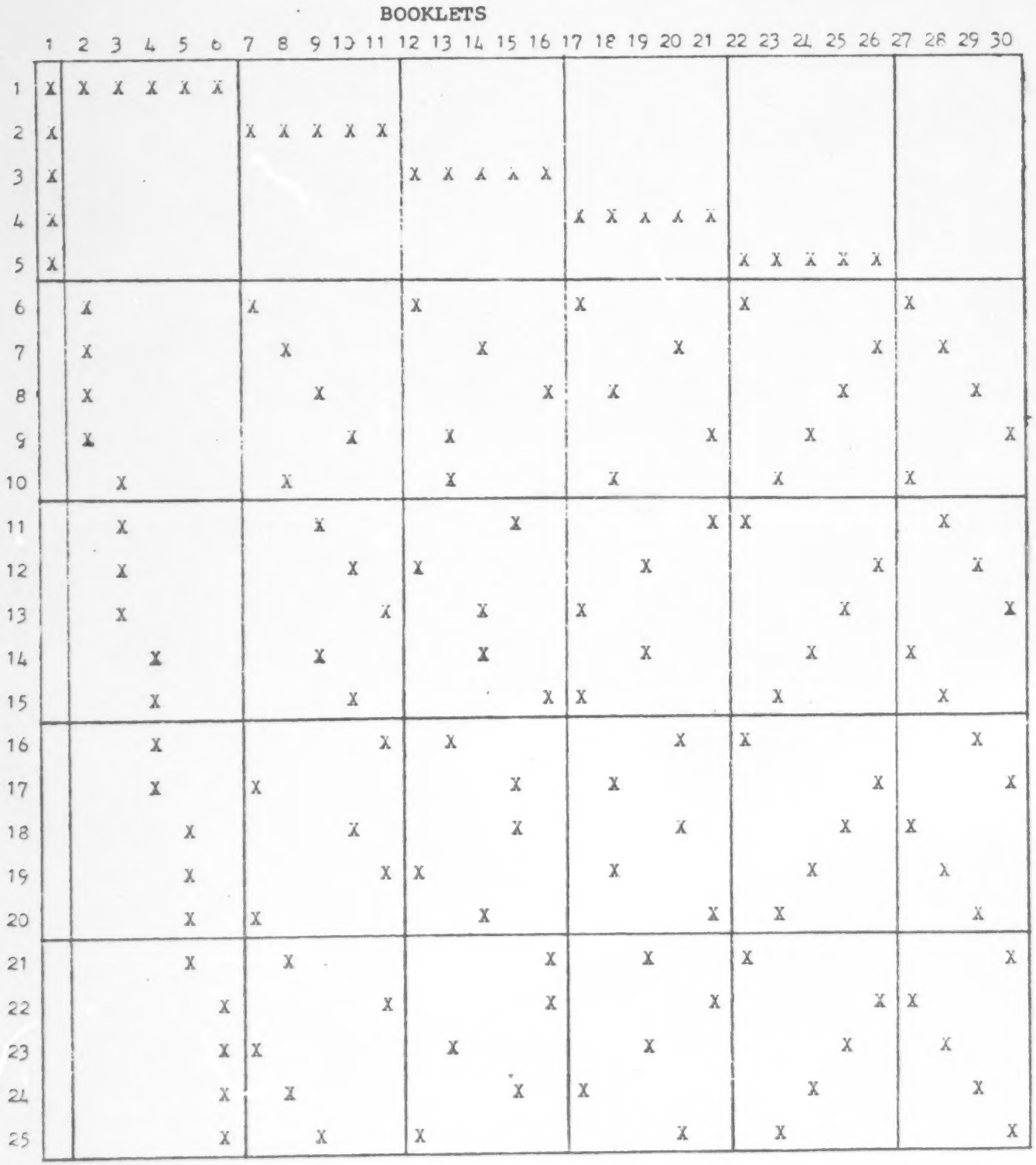

Fig. 4: Twenty-five Groups Distributed in Thirty Booklets

Source: Derman, op.cit. p. 4

e. As a result of this assignment, each booklet will be made up from 5 groups, and no booklet will contain the same 5 groups.

f. N per task statement = .2 x total number of respondents; that is, the number of respondents per task statement = 20% of the total number of respondents.

Administration of the Mini-Booklet Task Inventory Questionnaire.

1. Number the booklets as follows:

   a. For the 6 booklet, 1 through 6.

   b. For the 10 booklet, 1 through 10.

   c. For the 15 booklet, 1 through 15.

   d. For the 30 booklet, 1 through 30.

2. Divide the total number of respondents by the number of booklets.

   Example: For 600 respondents and 6 booklets, 600 ÷ 6 = 100.

3. Administer that number of each booklet to the respondents.

   In the above example: 100 of the respondents will get booklet 1, 100 will get booklet 2, etc.

Statistical Analysis

1. Total sample size (N) = total number of respondents.

2. Task statement sample size (n) is as follows:

   a. For the 6 booklet, .5N.

   b. For the 10 booklet, .4N.

   c. For the 15 booklet, .333 N.

   d. For the 30 booklet, .2N.

3. In compiling the data:

   a. Retain the original task statement number, or

   b. Prepare a simple code for each of the booklets.

4. Then apply standard statistical analysis procedures.

APPENDIX B

MEASURES OF READABILITY USED IN EVALUATING TASK INVENTORIES

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MEASURES OF READABILITY USED IN EVALUATING TASK INVENTORIES

Dale-Chall Formula:

Criteria: average sentence length
percentage of unfamiliar words not on Dale-Chall list of 3,000 familiar words

Formula: (.0496 x average sentence length) + (.1579 x % unfamiliar words) + 3.6365 = Raw Score

Raw Score is then converted to school grade level by using the following table:

Raw Score	Corrected Grade Level
4.9 and below	Grade IV and below
5.0 to 5.9	Grades V-VI
6.0 to 6.9	Grades VII-VIII
7.0 to 7.9	Grades IX-X
8.0 to 8.9	Grades XI-XII
9.0-to 9.9	Grades XIII-XV (college)
10.0 and above	Grade XVI + (college graduate)

Sampling techniques recommended by Dale and Chall:

1. Sample Selection: Books--take approximately 100 words about every tenth page. Articles--select about four 100-word samples per 2,000 words. Space the samples evenly. For passages of about 200 to 300 words, analyze the entire passage. Never begin or end a sample in the middle of a sentence.

2. Word count: Count the total number of words in the sample, counting as one word, (a) hyphenated words and contractions, (b) compound names of persons and places, and (c) initials which are part of a name.

3. Average sentence length: Count the number of complete sentences in the sample and divide this into the number of words.

4. Count of unfamiliar words: Count all words as unfamiliar which do not appear on the Dale List of 3,000 Familiar Words (see Appendix D).

5. Special rules for the word count and the count of unfamiliar words:
   A. Common Nouns:
      (1) Consider familiar all regular plurals and possessives of words on the list.

(2) Count irregular plurals as unfamiliar, even if the singular form appears on the list.

(3) Count as unfamiliar a noun that is formed by adding er or r to a noun or verb appearing on the word list (unless the er or r form is indicated on the list).

B. Proper Nouns:

(1) Names of persons and places are considered familiar.

(2) Names of organizations, laws, documents, titles of books, movies, and so on generally comprise several words.

a. For the total word count each word is counted no matter how many times the name is repeated in the sample.

b. For the unfamiliar word count, consider unfamiliar only words which do not appear on the Dale list, except names of persons or places. Chicago Building Association is counted one unfamiliar word--Association, Building and Chicago are familiar. Declaration of Independence is counted as two unfamiliar words--of is on the list. If a name of an organization, etc., is used more than twice, count it only twice when making the unfamiliar word count.

(3) Abbreviations:

a. For the total word count an abbreviation is counted as one word, and each repeat use within the sample is counted.

b. For the unfamiliar word count the abbreviation is counted as one word, but for repeated uses over two times within the sample the abbreviation is given a count of two unfamiliar words.

C. Verbs:

(1) Consider familiar the third-person plural forms, present-participle forms, past-participle forms, and past-tense forms, when these are added to verbs on the list.

(2) The same rule applies when a consonant is doubled before adding ing or ed.

D. Adjectives:

(1) Comparatives and superlatives of adjectives appearing on the list are considered familiar.

(2) Adjectives formed by adding N to a proper noun are familiar.

(3) Count as unfamiliar an adjective that is formed by adding y to a word that appears on the list. But consider the word familiar if y appears in parentheses following the word.

E. Adverbs:

(1) Consider adverbs familiar which are formed by adding by to a word on the list.

(2) Count as unfamiliar words which add more than ly, like easily.

F. Hyphenated Words: Count hyphenated words as unfamiliar if either word in the compound does not appear on the word list. When both appear on the list, the word is familiar.

G. Miscellaneous Special Cases:
(1) Words formed by adding en to a word on the list (unless the en is listed in parentheses or the word itself appears on the list) are considered unfamiliar.

(2) Count a word unfamiliar if two or more endings are added to a word on the list.

(3) Words on the list to which -tion, -ation, -ment, and other suffixes not previously mentioned are added are considered unfamiliar, unless the word with the ending is included on the list.

6. Per cent unfamiliar words: Divide the number of unfamiliar words in the sample by the total word count and multiply by 100.

Flesch Formula:

Criteria: average sentence length and number of syllables per 100 words

Formula: 206.835 - (1.015 x average sentence length) - (.846 x number of syllables per 100 words) = Reading Ease Score

Reading Ease Score is converted to school grade level by means of the following table:

Reading Ease Score	School Grade Level
90 to 100	5th grade
80 to 90	6th grade
70 to 80	7th grade
60 to 70	8th or 9th grade
50 to 60	10th to 12th grade
30 to 50	13th to 16th grade
0 to 30	College graduate

Sampling techniques recommended by Flesch:

1. Number of samples: 3 to 5 for an article, 25 to 30 for a book.

2. Sample selection: Eliminate first paragraph, then select paragraphs mathematically, such as every third paragraph or the second paragraph of every third page.

3. Sentence selection: Choose the sentences using the first 100 words (or closest thereto) of the paragraphs selected.

4. Average sentence length: Count the sentences selected from all samples used. Count the words in thse sentences. Average sentence length = total words in sentences selected ÷ number of sentences selected.

5. Number of syllables per 100 words: Count the number of syllables in all of the samples selected and divide by the total number of words in the samples.

FOG Index:

Criteria: average sentence length and percentage of polysyllable words

Formula: (average sentence length + % polysyllable words) x .4 = School grade level

Sampling techniques recommended by Gunning:

1. Sample selection: Select several 100 word samples spaced evenly through the piece.

2. Average sentence length. Count the number of sentences in each of the 100 word samples, including the sentence ending closest to the 100 words. Count the words in all the sentences. Average sentence length = number of all words in the samples ÷ number of all sentences in the samples.

3. Per cent of polysyllable words: Count the number of words of three or more syllables in the samples selected and divide by the total number of words in the samples. Do not count words that are: (a) proper names, (b) combinations of short easy words (like "bookkeeper" and "manpower"), (c) verb forms made three syllables by adding -ed or -es (like "created" or "trespasses").

SMOG Grading:

Criterion: number of polysyllable words in a 30-sentence sample

Formula: square root of the number of polysyllable words in sample (rounded to nearest perfect square) + 3.0 = School grade level

Sampling techniques recommended by McLaughlin:

1. Sample selection: Count 10 consecutive sentences near the beginning of the text, 10 in the middle, and 10 near the end. Count as a sentence any string of words ending with a period, question mark, or exclamation point.

2. Number of polysyllable words in the 30 sentence sample: Count every word of three or more syllables. Any string of letters or numerals beginning

and ending with a space or punctuation mark should be counted if you can distinguish at least three syllables when you read it aloud in context. If a polysyllabic word is repeated, count each repetition.

3. Estimating the square root of the number of polysyllabic words counted: This is done by taking the square root of the nearest perfect square. For example, if the count is 95, the nearest perfect square is 100, which yields a square root of 10. If the count lies roughly between two perfect squares, choose the lower number. For instance, if the count is 110, take the square root of 100 rather than that of 121.

Forbes-Cottle Method:

Criteria: arbitrary selection of difficult words in sample that had weight of 4 or more in the Thorndike Century Junior Dictionary

Formula: sum the weights of the difficult words ÷ number of words in sample = index of vocabulary difficulty

Indices are converted into school grade level by means of the following table:

Index of Vocabulary Difficulty	Grade Level
1.4510 and above	College
1.2510-1.4509	12th grade
1.0510-1.2509	11th grade
.8510-1.0509	10th grade
.6510- .8509	9th grade
.4510- .6509	8th grade
.2510- .4509	7th grade
.0510- .2509	6th grade
.0509 and below	5th grade

Sampling techniques recommended by Forbes and Cottle:

1. Number of samples: Take three samples of 100 words each.

2. Sample selection: Begin with the first word of the first item of the selection to be tested and count the first hundred word sample exactly. The middle sample is selected as near the midpoint of the test item as possible. Starting with the middle word, count backword fifty words. Using that word as a starting place count 100 words exactly. The third sample is taken by counting backwards 100 words from the last word of the selection to be tested.

3. Sum of weights of the difficult words: The weights of all words in the three samples having a weighting as given in the 1942 Thorndike Junior Century Dictionary of 4 or greater are summed.

4. Number of words in the sample: Three samples of exactly 100 words each equals 300 words.

FORCAST readability in reading grade level (RGL):

Criteria: count the number of one-syllable words in a 150-word passage divide that number by 10 and subtract that value from 20

Formula: $20 - \frac{\text{number of one-syllable words}}{10} = \text{RGL}$

RGL: Reading grade level

Sampling techniques recommended by Caylor, Sticht, Fox, and Ford:

1. Applicability of FORCAST: FORCAST is designed primarily for use on military regulations and manuals.

2. Sample selection: Passages are deemed appropriate if they contain 150 words of prose (excluding tables) on either one subject or two closely related subjects. Passages should also be selected to represent the MOS under study.

3. Number of one-syllable words: The number of one-syllable words in the 150 word sample is counted. Syllabification is determined by the spoken language; for example the number 14 is treated as the two-syllable word "four-teen." Hyphenated words are treated as a single word, and are considered polysyllabic. In case of doubt, a dictionary is to be consulted.

APPENDIX C

AN EXPLANATION OF THE WEIGHTINGS USED IN THE THORNDIKE CENTURY JUNIOR DICTIONARY

APPENDIX C

AN EXPLANATION OF THE WEIGHTINGS USED IN THE THORNDIKE CENTURY JUNIOR DICTIONARY

The Forbes-Cottle method of determining readability difficulty relies upon the word frequency weightings used in Thorndike Century Junior Dictionary.[1] These numbers tell how widely used the word is. "1 means that the word is one of the thousand most widely used words; 2 means that the word is one of the next most widely used thousand; 3 means that the word is in the third thousand; and so on to 20 for the twentieth thousand... The meanings of the number 1 to 20 in terms of occurrences per million words are approximately as follows:

Successive Thousands	Number of occurrences of each word per million words
1	100 or more
2	55 to 99
3	35 to 54
4	27
5	20
6	15
7	12
8	9
9	6
10	4
11	3½
12	3+
13	2 2/3
14	2 1/3
15	2
16	1 3/4
17	1½
18	1¼
19	a little over 1 per million
20	a little under 1 per million

1. Thorndike, E.L., THORNDIKE CENTURY JUNIOR DICTIONARY (rev. ed.), New York: Scott, Foresman and Company, 1942.

A word numbered 10 will thus on the average occur twice as often as one numbered 15; a word numbered 15 will on the average occur twice as often as one numbered 20. "Whenever there is need to know how often a word is used in print, these numbers are the best guide now available." [2]

For instance, the word auxiliary has a weight designation of 10, as opposed to the word opportunity, which has a weighting of 2. The following list is provided as a sample of various words and the frequency weights given them. The words used in this example were selected from task inventories for Occupational Field 44 (Legal Services) and OF 13 (Construction, Equipment and Shore Party).

Perform	1
Draft	3
Description	3
Instructions	3
Reconcile	4
Inquiries	5
Interview	5
Install	5
Accurately	7
Participate	7
Coordinate	9
Transcribe	12
Proceedings	13
Fabricate	14
Ensure	17
Questionnaire, Punitive, Evaluate	No rating. That is, these words are less widely used and therefore were not assigned weights.

2. Ibid., p. xiii-xiv.

APPENDIX D

SAMPLE ATTITUDE SURVEY

WE WANT TO KNOW HOW YOU FEEL ABOUT THE INVENTORY YOU JUST TOOK!

Directions: You can help us find out by circling one of the numbers from 1 to 7 to the right of each statement. For example, on statement 1, if you strongly agree it was interesting to take, circle "1". If you strongly disagree with the statement, circle "7". If you neither strongly agree nor strongly disagree, circle whichever number between 1 and 7 most closely matches your feeling.

	Strongly Agree	Agree	Somewhat Agree	Neither Agree Nor disagree	Somewhat Disagree	Disagree	Strongly Disagree
1. I found it interesting to take.	1	2	3	4	5	6	7
2. I found it easy to get through.	1	2	3	4	5	6	7
3. It was easy to read.	1	2	3	4	5	6	7
4. The inventory was too long.	1	2	3	4	5	6	7
5. I was able to find all the tasks I do.	1	2	3	4	5	6	7
6. The words used in the task statements were the words I use on the job.	1	2	3	4	5	6	7
7. The instructions were easy to follow.	1	2	3	4	5	6	7
8. Ifound many words I didn't know.	1	2	3	4	5	6	7
9. I'm glad I had the chance to say what I do in my MOS	1	2	3	4	5	6	7

(Please turn to page 2)

Please use this page to make any other comments you have about the inventory and its administration.

APPENDIX E

DALE LIST OF FAMILIAR WORDS

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DALE LIST OF FAMILIAR WORDS

Although the Dale list of familiar words contains many words that are not likely to be used in task statements for Task Inventories, it is considered that within the list are a number of words that may be applicable. Perhaps the greatest values of the list may be found in preparation of instructions for Task Inventories and in helping writers of task statements to focus upon the simplest words that can be used and still maintain precision in the statements.

A description by Dale and Chall of development of the list, cautions in its use, and the list itself follow: "The Dale list of approximately three thousand familiar words represents words that are known in reading by at least 80 per cent of the children in Grade IV. It is presented primarily as a list which gives a significant correlation with reading difficulty. It is not intended as a list of the most important words for children or adults. It includes words that are relatively unimportant and exludes some important ones. To use the list for more than an over-all statistical device which gives a good prediction of readability would be out of harmony with the purpose for which it was constructed.

"The technique used for constructing the list was crude. When 80 per cent of the fourth-graders questioned indicated that they knew a word, that word was included in the list. This arbitary cutting off at the 80-per cent point and the lack of any measure of the importance of these words make exceedingly dubious the wisdom of using individual words in appraising the ease or difficulty of material. For purposes of computing a level of difficulty, however, the percentage of words outside this list is a very good index of the difficulty of reading materials. The terms familiar and unfamiliar describing words are therefore used here in a statistical sense."[1]

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1. Dale, Edgar and Chall, Jeanne S., A Formula for Predicting Readability: Instructions, EDUCATIONAL RESEARCH BULLETIN, February 18, 1948, pp. 44-54.

DALE LIST OF 3000 FAMILIAR WORDS

a
able
aboard
about
above
absent
accept
accident
account
ache(ing)
acorn
acre
across
act(s)
add
address
admire
adventure
afar
afraid
after
afternoon
afterward(s)
again
against
age
aged
ago
agree
ah
ahead
aid
aim
air
airfield
airport
airplane
airship
airy
alarm
alike
alive
all
alley
alligator
allow
almost
alone
along
aloud
already
also
always
am
America
American
among
amount
an
and
angel
anger
angry
animal
another
answer
ant
any
anybody
anyhow
anyone
anything
anyway
anywhere
apart
apartment
ape
apiece
appear
apple
April
apron
are
aren't
arise
arithmetic
arm
armful
army
arose
around
arrange
arrive(d)
arrow
art
artist
as
ash(es)
aside
ask
asleep
at
ate
attack
attend
attention
August
aunt
author
auto
automobile
autumn
avenue
awake(n)
away
awful(ly)
awhile
ax
baa
babe
baby(ies)
back
background
backward(s)
bacon
bad(ly)
badge
bag
bake(r)
baking
bakery
ball

balloon
banana
band
bandage
bang
banjo
banker(er)
bar
barber
bare(ly)
barefoot
bark
barn
barrel
base
baseball
basement
basket
bat
batch
bath
bathe
bathing
bathroom
bathtub
battle
battleship
bay
be(ing)
beach
bead
beam
bean
bear
beard
beast
beat(ing)
beautiful
beautify
beauty
became
because
become
becoming
bed
bedbug
bedroom
bedspread
bedtime
bee
beech
beef
beefsteak
beehive
been
beer
beet
before
beg
began
beggar
begged
begin
beginning
begun
behave
behind
believe
bell
belong
below
belt
beneath
bench
bend
bent
berry(ies)
beside(s)
best
bet
better
between
bib
bible
bicycle
bid
big(ger)
bill
billboard
bin
bind
bird
birth
birthday
biscuit
bit
bite
biting
bitter
black
blackberry
blackbird
blackboard
blackness
blacksmith
blame
blank
blanket
blast
blaze
bleed
bless
blessing
blew
blind(s)
blindfold
block
blood
bloom
blossom
blot
blow
blue
blueberry
bluebird
bluejay
blush
board
boast
boat
bob
bobwhite
body(ies)
boil(er)
bold
bone
bonnet
boo
book
bookcase
bookkeeper
boom
boot
born
borrow
boss
both
bother
bottle
bottom
bought
bounce
bow
bowl
bow-wow
box(es)
boxcar
boxer
boy
boyhood
bracelet
brain
brake
bran
branch
brass
brave
bread
break
breakfast
breast
breath
breathe
breeze
brick
bride
bridge
bright
brightness
bring
broad
broadcast
broke(n)
brook
broom
brother
brought
brown
brush
bubble
bucket
buckle
bud
buffalo
bug
buggy
build
building
built
bulb
bull
bullet
bum
bumblebee
bump
bun
bunch
bundle

bunny
burn
burst
bury
bus
bush
bushel
business
busy
but
butcher
butt
butter
buttercup
butterfly
buttermilk
butterscotch
button
buttonhole
buy
buzz
by
bye
cab
cabbage
cabin
cabinet
cackle
cage
cake
calendar
calf
call(er)
came
camel
camp
campfire
can
canal
canary
candle
candlestick
candy
cane
cannon
cannot
canoe
can't
canyon
cap
cape
capital
captain
car
card
cardboard
care
careful
careless
carelessness
carload
carpenter
carpet
carriage
carrot
carry
cart
carve
case
cash
cashier
castle
cat
catbird
catch
catcher
caterpillar
catfish
catsup
cattle
caught
cause
cave
ceiling
cell
cellar
cent
center
cereal
certain(ly)
chain
chair
chalk
champion
chance
change
chap
charge
charm
chart
chase
chatter
cheap
cheat
check
checkers
cheek
cheer
cheese
cherry
chest
chew
chick
chicken
chief
child
childhood
children
chill(y)
chimney
chin
china
chip
chipmunk
chocolate
choice
choose
chop
chorus
chose(n)
christen
Christmas
church
churn
cigarette
circle
circus
citizen
city
clang
clap
class
classmate
classroom
claw
clay
clean(er)
clear
clerk
clever
click
cliff
climb
clip
cloak
clock
close
closet
cloth
clothes
clothing
cloud(y)
clover
clown
club
cluck
clump
coach
coal
coast
coat
cob
cobbler
cocoa
coconut
cocoon
cod
codfish
coffee
coffeepot
coin
cold
collar
college
color(ed)
colt
column
comb
come
comfort
comic
coming
company
compare
conductor
cone
connect
coo
cook(ed)
cook(ing)
cooky(ie)(s)
cool(er)
coop
copper
copy
cord
cork
corn

corner
correct
cost
cot
cottage
cotton
couch
cough
could
couldn't
count
counter
country
county
course
court
cousin
cover
cow
coward(ly)
cowboy
cozy
crab
crack
cracker
cradle
cramps
cranberry
crank(y)
crash
crawl
crazy
cream(y)
creek
creep
crept
cried
croak
crook(ed)
crop
cross(ing)
cross-eyed
crow
crowd(ed)
crown
cruel
crumb
crumble
crush
crust
cry(ies)
cub
cuff
cup
cupboard
cupful
cure
curl(y)
curtain
curve
cushion
custard
customer
cut
cute
cutting
dab
dad
daddy
daily
dairy
daisy
dam
damage
dame
damp
dance(r)
dancing
dandy
danger(ous)
dare
dark(ness)
darling
darn
dart
dash
date
daughter
dawn
day
daybreak
daytime
dead
deaf
deal
dear
death
December
decide
deck
deed
deep
deer
defeat
defend
defense
delight
den
dentist
depend
deposit
describe
desert
deserve
desire
desk
destroy
devil
dew
diamond
did
didn't
die(d)(s)
difference
different
dig
dim
dime
dine
ding-dong
dinner
dip
direct
direction
dirt(y)
discover
dish
dislike
dismiss
ditch
dive
diver
divide
do
dock
doctor
does
doesn't
dog
doll
dollar
dolly
done
donkey
don't
door
doorbell
doorknob
doorstep
dope
dot
double
dough
dove
down
downstairs
downtown
dozen
drag
drain
drank
draw(er)
draw(ing)
dream
dress
dresser
dressmaker
drew
dried
drift
drill
drink
drip
drive(n)
driver
drop
drove
drown
drowsy
drug
drum
drunk
dry
duck
due
dug
dull
dumb
dump
during
dust(y)
duty
dwarf
dwell
dwelt
drying
each
eager
eagle
ear
early
earn
earth
east(ern)
easy
eat(en)

edge
egg
eh
eight
eighteen
eighth
eighty
either
elbow
elder
eldest
electric
electricity
elephant
eleven
elf
elm
else
elsewhere
empty
end(ing)
enemy
engine
engineer
English
enjoy
enough
enter
envelope
equal
erase(r)
errand
escape
eve
even
evening
ever
every
everybody
everyday
everyone
everything
everywhere
evil
exact
except
exchange
excited
exciting
excuse
exit
expect

explain
extra
eye
eyebrow
fable
face
facing
fact
factory
fail
faint
fair
fairy
faith
fake
fall
false
family
fan
fancy
far
faraway
fare
farmer
farm(ing)
far-off
farther
fashion
fast
fasten
fat
father
fault
favor
favorite
fear
feast
feather
February
fed
feed
feel
feet
fell
fellow
felt
fence
fever
few
fib
fiddle
field

fife
fifteen
fifth
fifty
fig
fight
figure
file
fill
film
finally
find
fine
finger
finish
fire
firearm
firecracker
fireplace
fireworks
firing
first
fish
fisherman
fist
fit(s)
five
fix
flag
flake
flame
flap
flash
flashlight
flat
flea
flesh
flew
flies
flight
flip
flip-flop
float
flock
flood
floor
flop
flour
flow
flower(y)
flutter
fly

foam
fog
foggy
fold
folks
follow(ing)
fond
food
fool
foolish
foot
football
footprint
for
forehead
forest
forget
forgive
forgot(ten)
fork
form
fort
forth
fortune
forty
forward
fought
found
fountain
four
fourteen
fourth
fox
frame
free
freedom
freeze
freight
French
fresh
fret
Friday
fried
friend(ly)
friendship
frighten
frog
from
front
frost
frown
froze

fruit
fry
fudge
fuel
full(y)
fun
funny
fur
furniture
further
fuzzy
gain
gallon
gallop
game
gang
garage
garbage
garden
gas
gasoline
gate
gather
gave
gay
gear
geese
general
gentle
gentleman
gentlemen
geography
get
getting
giant
gift
gingerbread
girl
give(n)
giving
glad(ly)
glance
glass(es)
gleam
glide
glory
glove
glow
glue
go(ing)
goes
goal
goat
gobble

God(g)
godmother
gold(en)
goldfish
golf
gone
good(s)
good-by(bye)
good-looking
goodness
goody
goose
gooseberry
got
govern
government
gown
grab
gracious
grade
grain
grand
granchild
grandchildren
granddaughter
grandfather
grandma
grandmother
grandpa
grandson
grandstand
grape(s)
grapefruit
grass
grasshopper
grateful
grave
gravel
graveyard
gravy
gray
graze
grease
great
green
greet
grew
grind
groan
grocery
ground
group
grove
grow

guard
guess
guest
guide
gulf
gum
gun
gunpowder
guy
ha
habit
had
hadn't
hail
hair
haircut
hairpin
half
hall
halt
ham
hammer
hand
handful
handkerchief
handle
handwriting
hang
happen
happily
happiness
happy
harbor
hard
hardly
hardship
hardware
hare
hark
harm
harness
harp
harvest
has
hasn't
haste(n)
hasty
hat
hatch
hatchet
hate
haul
have
haven't

having
hawk
hay
hayfield
haystack
he
head
headache
heal
health(y)
heap
hear(ing)
heard
heart
heat(er)
heaven
heavy
he'd
heel
height
held
hell
he'll
hello
helmet
help(er)
helpful
hem
hen
henhouse
her(s)
herd
here
here's
hero
herself
he's
hey
hickory
hid
hidden
hide
high
highway
hill
hillside
hilltop
hilly
him
himself
hind
hint
hip
hire

his
hiss
history
hit
hitch
hive
ho
hoe
hog
hold(er)
hole
holiday
hollow
holy
home
homely
homesick
honest
honey
honeybee
honeymoon
honk
honor
hood
hoof
hook
hoop
hop
hope(ful)
hopeless
horn
horse
horseback
horseshoe
hose
hospital
host
hot
hotel
hound
hour
house
housetop
housewife
housework
how
however
howl
hug
huge
hum
humble
hump
hundred
hung
hunger
hungry
hunk
hunt(er)
hurrah
hurried
hurry
hurt
husband
hush
hut
hymn
I
ice
icy
I'd
idea
ideal
if
ill
I'll
I'm
important
impossible
improve
in
inch(es)
income
indeed
Indian
indoors
ink
inn
insect
inside
instant
instead
insult
intend
interested
interesting
into
invite
iron
is
island
isn't
it
its
it's
itself
I've
ivory
ivy
jacket
jacks
jail
jam
January
jar
jaw
jay
jelly
jellyfish
jerk
jig
job
jockey
join
joke
joking
jolly
journey
joy(ful)
joyous
judge
jug
juice
juicy
July
jump
June
junior
junk
just
keen
keep
kept
kettle
key
kick
kid
kill(ed)
kind(ly)
kindness
king
kingdom
kiss
kitchen
kite
kitten
kitty
knee
kneel
knew
knife
knit
knives
knob
knock
knot
know
known
lace
lad
ladder
ladies
lady
laid
lake
lamb
lame
lamp
land
lane
language
lantern
lap
lard
large
lash
lass
last
late
laugh
laundry
law
lawn
lawyer
lay
lazy
lead
leader
leaf
leak
lean
leap
learn(ed)
least
leather
leave(ing)
led
left
leg
lemon
lemonade
lend

length
less
lesson
let
let's
letter
letting
lettuce
level
liberty
library
lice
lick
lid
lie
life
lift
light(ness)
lightning
like
likely
liking
lily
limb
lime
limp
line
linen
lion
lip
list
listen
lit
little
live(s)
lively
liver
living
lizard
load
loaf
loan
loaves
lock
locomotive
log
lone
lonely
lonesome
long
look
lookout

loop
loose
lord
lose(r)
loss
lost
lot
loud
love
lovely
lover
low
luck(y)
lumber
lump
lunch
lying
ma
machine
machinery
mad
made
magazine
magic
maid
mail
mailbox
mailman
major
make
making
male
mama
mamma
man
manager
mane
manger
many
map
maple
marble
march(M)
mare
mark
market
marriage
married
marry
mask
mast
master

mat
match
matter
mattress
may(M)
maybe
mayor
maypole
me
meadow
meal
mean(s)
meant
measure
meat
medicine
meet(ing)
melt
member
men
mend
meow
merry
mess
message
met
metal
mew
mice
middle
midnight
might(y)
mile
milk
milkman
mill
miller
million
mind
mine
miner
mint
minute
mirror
mischief
miss(M)
misspell
mistake
misty
mitt
mitten
mix

moment
Monday
money
monkey
month
moo
moon
moonlight
moose
mop
more
morning
morrow
moss
most(ly)
mother
motor
mount
mountain
mouse
mouth
move
movie
movies
moving
mow
Mr., Mrs.
much
mud
muddy
mug
mule
multiply
murder
music
must
my
myself
nail
name
nap
napkin
narrow
nasty
naughty
navy
near
nearby
nearly
neat
neck
necktie

need
needle
needn't
Negro
neighbor
neighborhood
neither
nerve
nest
net
never
nevermore
new
news
newspaper
next
nibble
nice
nickel
night
nightgown
nine
nineteen
ninety
no
nobody
nod
noise
noisy
none
noon
nor
north(ern)
nose
not
note
nothing
notice
November
now
nowhere
number
nurse
nut
oak
oar
oatmeal
oats
obey
ocean
o'clock
October
odd
of
off
offer
office
officer
often
oh
oil
old
oldfashioned
on
once
one
onion
only
onward
open
or
orange
orchard
order
ore
organ
other
otherwise
ouch
ought
our(s)
ourselves
out
outdoors
outfit
outlaw
outline
outside
outward
oven
over
overalls
overcoat
overeat
overhead
overhear
overnight
overturn
owe
owing
owl
own(er)
ox
pa
pace
pack
package
pad
page
paid
pail
pain(ful)
paint(er)
painting
pair
pal
palace
pale
pan
pancake
pane
pansy
pants
papa
paper
parade
pardon
parent
park
part(ly)
partner
party
pass
passenger
past
paste
pasture
pat
patch
path
patter
pave
pavement
paw
pay
payment
pea(s)
peace(ful)
peach(es)
peak
peanut
pear
pearl
peck
peek
peel
peep
peg
pen
pencil
penny
people
pepper
peppermint
perfume
perhaps
person
pet
phone
piano
pick
pickle
picnic
picture
pie
piece
pig
pigeon
piggy
pile
pill
pillow
pin
pine
pineapple
pink
pint
pipe
pistol
pit
pitch
pitcher
pity
place
plain
plan
plane
plant
plate
platform
platter
play(er)
playground
playhouse
playmate
plaything
pleasant
please

pleasure
plenty
plow
plug
plum
pocket
pocketbook
poem
point
poison
poke
pole
police
policeman
polish
polite
pond
ponies
pony
pool
poor
pop
popcorn
popped
porch
pork
possible
post
postage
postman
pot
potato(es)
pound
pour
powder
power(ful)
praise
pray
prayer
prepare
present
pretty
price
prick
prince
princess
print
prison
prize
promise
proper
protect

proud
prove
prune
public
puddle
puff
pull
pump
pumpkin
punch
punish
pup
pupil
puppy
pure
purple
purse
push
puss
pussy
pussycat
put
putting
puzzle
quack
quart
quarter
queen
queer
question
quick(ly)
quiet
quilt
quit
quite
rabbit
race
rack
radio
radish
rag
rail
railroad
railway
rain(y)
rainbow
raise
raisin
rake
ram
ran
ranch

rang
rap
rapidly
rat
rate
rather
rattle
raw
ray
reach
read
reader
reading
ready
real
really
reap
rear
reason
rebuild
receive
recess
record
red
redbird
redbreast
refuse
reindeer
rejoice
remain
remember
remind
remove
rent
repair
repay
repeat
report
rest
return
review
reward
rib
ribbon
rice
rich
rid
riddle
ride(r)
riding
right
rim

ring
rip
ripe
rise
rising
river
road
roadside
roar
roast
rob
robber
robe
robin
rock(y)
rocket
rode
roll
roller
roof
room
rooster
root
rope
rose
rosebud
rot
rotten
rough
round
route
row
rowboat
royal
rub
rubbed
rubber
rubbish
rug
rule(r)
rumble
run
rung
runner
running
rush
rust(y)
rye
sack
sad
saddle
sadness

safe
safety
said
sail
sailboat
sailor
saint
salad
sale
salt
same
sand(y)
sandwich
sang
sank
sap
sash
sat
satin
satisfactory
Saturday
sausage
savage
save
savings
saw
say
scab
scales
scare
scarf
school
schoolboy
schoolhouse
schoolmaster
schoolroom
scorch
score
scrap
scrape
scratch
scream
screen
screw
scrub
sea
seal
seam
search
season
seat
second
secret
see(ing)
seed
seek
seem
seen
seesaw
select
self
selfish
sell
send
sense
sent
sentence
separate
September
servant
serve
service
set
setting
settle
settlement
seven
seventeen
seventh
seventy
several
sew
shade
shadow
shady
shake(r)
shaking
shall
shame
shan't
shape
share
sharp
shave
she
she'd
she'll
she's
shear(s)
shed
sheep
sheet
shelf
shell
shepherd
shine
shining
shiny
ship
shirt
shock
shoe
shoemaker
shone
shook
shoot
shop
shopping
shore
short
shot
should
shoulder
shouldn't
shout
shovel
show
shower
shut
shy
sick(ness)
side
sidewalk
sideways
sigh
sight
sign
silence
silent
silk
sill
silly
silver
simple
sin
since
sing
singer
single
sink
sip
sir
sis
sissy
sister
sit
sitting
six
sixteen
sixth
sixty
size
skate
skater
ski
skin
skip
skirt
sky
slam
slap
slate
slave
sled
sleep(y)
sleeve
sleigh
slept
slice
slid
slide
sling
slip
slipped
slipper
slippery
slit
slow(ly)
sly
smack
small
smart
smell
smile
smoke
smooth
snail
snake
snap
snapping
sneeze
snow(y)
snowball
snowflake
snuff
snug
so
soak
soap
sob
socks
sod

soda
sofa
soft
soil
sold
soldier
sole
some
somebody
somehow
someone
something
sometime(s)
somewhere
son
song
soon
sore
sorrow
sorry
sort
soul
sound
soup
sour
south(ern)
space
spade
spank
sparrow
speak(er)
spear
speech
speed
spell(ing)
spend
spent
spider
spike
spill
spin
spinach
spirit
spit
splash
spoil
spoke
spook
spoon
sport
spot
spread
spring
springtime
sprinkle
square
squash
squeak
squeeze
squirrel
stable
stack
stage
stair
stall
stamp
stand
star
stare
start
starve
state
station
stay
steak
steal
steam
steamboat
steamer
steel
steep
steeple
steer
stem
step
stepping
stick(y)
stiff
still(ness)
sting
stir
stitch
stock
stocking
stole
stone
stood
stool
stoop
stop
stopped
stopping
store
stork
stories
storm(y)
story
stove
straight
strange(r)
strap
straw
strawberry
stream
street
stretch
string
strip
stripes
strong
stuck
study
stuff
stump
stung
subject
such
suck
sudden
suffer
sugar
suit
sum
summer
sun
Sunday
sunflower
sung
sunk
sunlight
sunny
sunrise
sunset
sunshine
supper
suppose
sure(ly)
surface
surprise
swallow
swam
swamp
swan
swat
swear
sweat
sweater
sweep
sweet(ness)
sweetheart
swell
swept
swift
swim
swimming
swing
switch
sword
swore
table
tablecloth
tablespoon
tablet
tack
tag
tail
tailor
take(n)
taking
tale
talk(er)
tall
tame
tan
tank
tap
tape
tar
tardy
task
taste
taught
tax
tea
teach(er)
team
tear
tease
teaspoon
teeth
telephone
tell
temper
ten
tennis
tent
term
terrible
test
than
thank(s)
thankful

Thanks-giving
that
that's
the
theater
thee
their
them
then
there
these
they
they'd
they'll
they're
they've
thick
thief
thimble
thin
thing
think
third
thirsty
thirteen
thirty
this
tho
thorn
those
though
thought
thousand
thread
three
threw
throat
throne
through
throw(n)
thumb
thunder
Thursday
thy
tick
ticket
tickle
tie
tiger
tight
till
time
tin
tinkle
tiny
tip
tiptoe
tire
tired
'tis
title
to
toad
toadstool
toast
tobacco
today
toe
together
toilet
told
tomato
ton
tone
tongue
tonight
too
took
tool
toot
tooth
toothbrush
toothpick
top
tore
torn
toss
touch
tow
toward(s)
towel
tower
town
toy
trace
track
trade
train
tramp
trap
tray
treasure
treat
tree
trick
tricycle
tried
trim
trip
trolley
trouble
truck
true
truly
trunk
trust
truth
try
tub
Tuesday
tug
tulip
tumble
tune
tunnel
turkey
turn
turtle
twelve
twenty
twice
twig
twin
two
ugly
umbrella
uncle
under
understand
underwear
undress
unfair
unfinished
unfold
unfriendly
unhappy
unhurt
uniform
United States
unkind
unknown
unless
unpleasant
until
unwilling
up
upon
upper
upset
upside
upstairs
uptown
upward
us
use(d)
useful
valentine
valley
valuable
value
vase
vegetable
velvet
very
vessel
victory
view
village
vine
violet
visit
visitor
voice
vote
wag
wagon
waist
wait
wake(n)
walk
wall
walnut
want
war
warm
warn
was
wash(er)
washtub
wasn't
waste
watch
watchman
water
watermelon
waterproof
wave
wax
way
wayside
we
weak(ness)
weaken
wealth
weapon
wear

weary
weather
weave
web
we'd
wedding
Wednesday
wee
weed
week
we'll
weep
weigh
welcome
well
went
were
we're
west(ern)
wet
we've
whale
what
what's
wheat
wheel
when
whenever
where
which
while
whip
whipped
whirl
whisky
whisper
whistle
white
who
who'd
whole
who'll
whom
who's
whose
why
wicked
wide
wife
wiggle
wild
wildcat
will
willing
willow
win
wind(y)
windmill
window
wine
wing
wink
winner
winter
wipe
wire
wise
wish
wit
witch
with
without
woke
wolf
woman
women
won
wonder
wonderful
won't
wood(en)
woodpecker
woods
wool
woolen
word
wore
work(er)
workman
world
worm
worn
worry
worse
worst
worth
would
wouldn't
wound
wove
wrap
wrapped
wreck
wrein
wring
write
writing
written
wrong
wrote
wrung
yard
yarn
year
yell
yellow
yes
yesterday
yet
yolk
yonder
you
you'd
you'll
young
youngster
your(s)
you're
yourself
yourselves
youth
you've

APPENDIX F

ACTIVITY VERB LIST

APPENDIX F

ACTIVITY VERB LIST[1]

The concept of "activity verbs", as the term is used in this report, emphasizes standardized definitions and hierarchies of difficulty and complexity in required performance. In a sense, the terminology is redundant, since a "verb" is by definition a word expressing an action. "Activity verbs", however, are selected words, listed -- with their precise meanings -- for the convenience of job analysts. Because definitions are sharply limited, they facilitate the reporting and recording of what may be significant distinctions among actions or activities. For the same reason, they permit meaningful comparisons of action in a variety of jobs.

In use, an activity verb list serves as a guide for job analysts in organizing and writing definitive statements with respect to each major activity in a job. With the activity verb list at hand, the analyst has before him a standardized, classified, and indexed vocabulary. An activity he describes as "compiling", for example, can be assumed to be quite similar to what another analyst, looking at another job, would see and describe with the same activity verb.

The need for and potential usefulness of such verbs became evident in the investigation of several new approaches to job analysis. It is clear that, since a job is precisely defined as work or effort to get something accomplished, any description of the job must emphasize what is done. The

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1. This discussion of activity verbs is based upon the description of the "Activity Verb List" in Stone, C. Harold and Yoder, Dale, JOB ANALYSIS 1970, (Appendix C), California State University, Long Beach, 1970.

"doing" involves action; its description requires a verb. Thus activity verbs describe what is done in assigned positions in hierarchies of required capabilities according to a revision of the UST&ES "worker function" classification.

Identification of appropriate levels and positions in the "data" and "people" areas can be accomplished on the basis of the action itself. This seems not to be the case in the "things" area, where ordering or ranking depends largely on the object of the action. Thus, for example, a "things" activity verb such as "cut" can be realistically defined and placed in the hierarchy of functions only if the object being cut is carefully noted and considered. Cutting lumber does not rate the same position as cutting diamonds. It appears at this time that task statements in the "things" area can be ranked in terms of their verbs only when the verbs are considered in context. The entire task statement must be recorded and evaluated.

Both as a contribution to the meaning of activity verbs and as a convenience in indicating relationships among jobs, the ranking process and the creation of hierarchies can be helpful. In the areas of people and data, the principal criteria for ordering appear to be the complexity of the action and the level of required skills. In the "things" area, these criteria may be applicable, but their application is in itself more difficult.[2]

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2. In one experimental approach to this problem as it arose in analyzing machine shop jobs, task statements were evaluated on a dual scale, one involving degrees of manual dexterity and the other degrees of complexity. The total task was positioned in the hierarchy on the basis of the highest degree on the two scales.

MODIFIED WORKER FUNCTIONS

In the process of developing the list of activity verbs and assigning them to the various levels of the D.O.T.[3] "worker function" hierarchy, several modifications in that hierarchy seemed necessary. In the "data" area, the function described as "computing" was retitled to become "figuring". "Comparing" was retitled "discriminating". These changes seemed to conform more closely to common usage.

Also, in the "data" area, the ordering was modified to assign a somewhat lower rank to "compiling" than was accorded this verb in the original hierarchy. "Compiling" was redefined, after a careful review of current definitions. The D.O.T. defines the term as:

> COMPILING: Gathering, collating, or classifying information about data, people, or things. Reporting and/or carrying out a prescribed action in relation to the information is frequently involved.

The revised definition is as follows:

> COMPILING: Measuring and collecting information about data, people, or things.

In the functional area of "people", a general category of "educating" was substituted for "instructing" to permit a more specific definition of "instruct". Similarly, the general category of "superintending" has been tentatively substituted for "supervising" to permit use of "supervise" as a specific verb within the broader category. The D.O.T. list has been

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3. U.S. Department of Labor, DICTIONARY OF OCCUPATIONAL TITLES-OCCUPATIONAL CLASSIFICATION, 3rd ed., Washington: U.S. Government Printing Office, Vol. II, 1965.

further modified by deleting "taking instructions--helping", because such action does not result directly in a product or service. Verbs that would have been classified under "helping" are presently included under "serving".

In the "people" area, "diverting" also has been redefined. The older definition indicates the meaning as "amusing others". The tentative revision is more specific; it defines "diverting" as:

> DIVERTING: Drawing the mind away from serious thoughts or pursuits; distracting the attention from work, worry, pain, or commonplace concerns and focusing it on pleasure.

The modified hierarchies for "data" and "people" thus become:

	DATA		PEOPLE
10	SYNTHESIZING	20	MENTORING
11	COORDINATING	21	NEGOTIATING
12	ANALYZING	22	EDUCATING
13	DISCRIMINATING	23	SUPERINTENDING
14	FIGURING	24	DIVERTING
15	COMPILING	25	PERSUADING
16	COPYING	26	SPEAKING/SIGNALING
		27	SERVING

For convenient comparison, the D.O.T. "data" and "people" lists are as follows:

	DATA		PEOPLE
0	SYNTHESIZING	0	MENTORING
1	COORDINATING	1	NEGOTIATING
2	ANALYZING	2	INSTRUCTING
3	COMPILING	3	SUPERVISING
4	COMPUTING	4	DIVERTING
5	COPYING	5	PERSUADING
6	COMPARING	6	SPEAKING-SIGNALING
7)	NO SIGNIFICANT RELATIONSHIP	7	SERVING
8)		8	NO SIGNIFICANT RELATIONSHIP

USE OF THE LIST

Later pages in this Appendix list activity verbs for "data" and "people" and the definitions attached to each verb. Sources of each definition are indicated by code in which "W" means Webster's Dictionary (Third World and Collegiate editions); "F&W" means Hayakawa, S. I. and the Funk & Wagnalls Dictionary Staff, Modern Guide to Synonyms and Related Words. New York: Funk & Wagnalls, 1968; and "S" identifies definitions developed, after consulting these and other sources, by members of the research staff.

It is important, for a full understanding of the application and use of these lists, to note that the only indicator of rank is that of each major worker function. Within each function, verbs are grouped according to similarity of meaning. The sub-groupings have been developed for convenience to permit greater precision in finding the closest approximation to the activity. In the list as presented here, verbs beginning with capital letters are regarded as "general", serving to classify the more specific but related verbs that begin with lower-case letters.

Major worker functions are coded by number. That same code applies to each verb in each functional level. The first digit of the code indicates the area; "1" means "data", "2" means "people"; and "3" would refer to "things". The second digit identifies the worker function level, with the highest designated "0", and other lower-scaled functions indicated as "1", "2", etc.

Use of the list may best be described by illustration. Suppose, an analyst seeking to develop a job description for an accounting

job interviews an incumbent. He takes notes on what he observes and what the employee says. One statement by the incumbent states that he "looks at accounting records to form an opinion as to their dependability." The analyst, reviewing his notes as he writes up what he has learned about the job, needs a more definitive verb than "looks at".

He can find the list helpful at this point, and use of the list can make the resulting job description both more precise and more readily comparable with those of other jobs. The area is clearly "data". Within that area, the most appropriate verb will probably be found in the "analyzing" or "discriminating" levels. Within these levels, several verbs appear worthy of consideration, including "scrutinizing", "examine", "audit", "verify", and "inspect". The analyst studies the attached definitions and selects "audit" as the most appropriate; it is defined as "to examine accounts or records". He then writes the element statement as "audits accounting records".

In the JIMS experimental procedure, element task statements from a variety of sources were revised, using this procedure. The rewritten statements were more meaningful and the activity was automatically assigned to the appropriate worker function and level. In the following examples, worker functions are indicated in parentheses.

"Plans methods for machining non-standard workpieces" (10-SYNTHESIZING)

"Formulates machining instructions for others" (11-Coordinating)

"Measures parts to determine conformance to specifications" (15-COMPILING)

"Demonstrates safety practice to workers" (22-TEACHING)

"Assigns duties to subordinates" (23-SUPERINTENDING)

Pages that follow first list activity verbs for data and people by function; thereafter each of these verbs is defined. The last two pages index all the activity verbs, with page references.

CLASSIFICATION OF "DATA" ACTIVITY VERBS

10. SYNTHESIZING

Devise
- compose
- invent
- discover
- hypothesize
- plan
- design

Solve
- calculate
- forecast
- interpret
- translate

11. COORDINATING

Direct
- manage
- implement
- control
- regulate
- authorize
- execute

Decide
- deliberate
- determine

Develop
- formulate

Organize
- marshal
- schedule

12. ANALYZING

Investigate
- research
- experiment
- study

Scrutinize
- examine
- audit
- scan

Evaluate
- verify
- appraise
- test

Report
- identify
- recommend
- summarize
- suggest

13. DISCRIMINATING

Compare
- rank
- inspect
- distinguish
- contrast
- select
- choose

Classify
- grade
- index
- segregate
- sort
- match
- arrange

14. FIGURING

Estimate
Compute
Plot

15. COMPILING

Measure
- time
- weigh
- calibrate

Collect
- accumulate
- inventory
- count
- observe
- smell
- listen

16. COPYING

Record
- post
- tabulate
- list
- transpose

Duplicate
- transcribe
- quote

CLASSIFICATION OF "PEOPLE" ACTIVITY VERBS

20. MENTORING

- Treat
  - prognosticate
  - diagnose
  - prescribe
- Advise
  - counsel
  - console
  - reconcile
- Arbitrate
  - judge

21. NEGOTIATING

- Mediate
  - settle
  - debate
  - bargain
  - reason
  - confer

22. EDUCATING

- Teach
  - lecture
  - tutor
  - explain
  - instruct
- Coach
  - demonstrate
  - train

23. SUPERINTENDING

- Supervise
  - lead
  - order
  - appoint
  - assign
  - enforce
  - rate

24. DIVERTING

- Entertain
  - humor
  - interest
  - amuse
  - imitate

25. PERSUADING

- Influence
  - motivate
  - convince
- Promote
- Solicit
- Sell

26. SPEAKING/SIGNALING

- Discuss
  - interview
  - consult
  - question
- Inform
  - dictate
  - answer
  - describe
  - indicate
  - relay
  - request
- Meet
  - greet

27. SERVING

- Assist
  - usher
- Attend
  - wait upon
- Supply
  - provide

"DATA" ACTIVITY VERB DEFINITIONS

10 - SYNTHESIZING - Integrating analyses of data to discover facts and/or develop knowledge concepts or interpretations. (D.O.T.)

Devise - to form in the mind by new combinations or applications of ideas or principles (W)

- compose - To create by artistic labor (W) [e.g., a musical score or painting]
- invent - to fabricate something useful; usually as a result of ingenious thinking or experimentation (W)
- discover - implies an intentional search; always suggests the acquiring of something that already exists but is new to the discoverer. (F&W)
- hypothesize - [to form] a tentative assumption...in order to draw out and test its logical or empirical consequences. (W)
- plan - to work out roughly in the mind a detailed means of achieving an objective or goal (S)
- design - to devise the form or shape of a physical object (S)

Solve - to answer a question or work out a problem...; explaining any set of events by finding a workable way of dealing with them or by seeing the deeper meaning of them (F&W)

- calculate - to ascertain or determine by mathematical processes...Calculate is usually preferred in reference to highly intricate process and problematical rather than exact or definite result. (W) Not to be confused with compute under "FIGURING."
- forecast - to calculate or predict (some future event or condition) usually as a result of rational study and analysis of available pertinent data (W) Not to be confused with the less complex estimate under "FIGURING."
- interpret - using "knowledge or insight to cast light on some baffling problem or puzzle..... stressing personal judgment or understanding" (F&W)
- translate - to transfer or turn from one set of symbols into another (W)

11 - COORDINATING - Determining time, place, and sequence of operations or actions to be taken on the basis of analysis of data; executing determinations and/or reporting on events (D.O.T.)

Direct - to exercise leadership and control at the highest level; authority is often delegated to others (e.g., corporate director) (S)
Syn: Administer

manage - ...often refers to the actual running or handling of specific affairs, and may imply delegated authority (F&W)

implement - to give practical effect to and ensure actual fulfillment by concrete measures (W)

control - is the function of maintaining awareness and appraisal with respect to the effectiveness of the organization and its parts in accomplishing assigned missions (Yoder, Personnel Management & Industrial Relations, 1962, P.614)

regulate - ...Means to order or control by rule, method, or established mode (F&W)

authorize - ...[to give] approval of a proposed course of action by an authority empowered either to permit or to forbid it. (F&W)

execute - to follow, carry out, or put into effect [the direction of others] (F&W)

Decide - to arrive at a decision that ends uncertainty (S)

deliberate - to reach a decision only after intense analysis; the variables involved are highly abstract; the consequences of the decision are considerable (S)

determine - to reach a decision only after intense analysis; the variables involved are readily apparent, but the consequences of the decision are considerable (S)

Develop - ...positive change in which an existing or rudimentary [idea] is improved, evoked, or perfected (F&W)

formulate - ...refers to an act...in which, the rough plan is spelled out, formalized, or put into words (F&W)

Organize - to set up an administrative structure in order to form a coherent or functioning whole (S)

marshal - ...items are brought together and ordered for greatest efficiency or for the most forceful effect possible (F&W)

schedule - to appoint, assign, or designate for a fixed future time (W)

12 - ANALYZING - Examining and evaluating data. Presenting alternative actions in relation to the evaluation is frequently involved. (D.O.T.)

Investigate - to investigate is to make a methodical, searching inquiry into a complex situation in an effort to uncover the facts. (F&W)

research - to investigate in order to discover or interpret facts, or to revise accepted laws or theories (S)

experiment - to test a theory or hypothesis under controlled conditions (S)

study - to attempt to learn all aspects of the subject or problem under scrutiny before making plans or taking definite action (F&W)

Scrutinize - to look something complex over closely but not necessarily in a systematic method as in "INVESTIGATE." (S)

examine - [to scrutinize] in order to determine the... condition or nature of a thing (W)

audit - to examine accounts or records (F&W)

scan - [to survey] from point to point often suggesting a cursory overall observation. (W)

Evaluate - to determine or fix the value of through analysis of complex data. (S)

verify - to confirm or establish the authenticity or existence of by examination, investigation, or competent evidence. (W)

appraise - to judge tentatively or approximately the value, worth, or significance of (W definition for "estimate")

test - to judge the performance of something relative to readily observable standards (S)

Report - implies giving an account of something with...formal attention to details and to accuracy in the presentation of the relevant facts and information (F&W)

identify - to point out the salient characteristics of something or associate it with some other thing. The characteristics and association are not readily apparent (S)

recommend - ...indicates a positive declaration, based on analysis of complex data, in favor of a particular alternative or set of possibilities (F&W)

summarize - to tell in, or reduce to, a summary (W)

12 - ANALYZING (Continued)

suggest - to call or bring to mind (as an idea, mood, or object) by a process of logical thought or natural association of ideas (W)

13 - DISCRIMINATING - Comparing and classifying information about data, people, or things. Reporting and/or carrying out a prescribed action in relation to the discrimination is frequently involved. (S)

Compare - to examine the readily apparent character or qualities of, especially to discover resemblances or differences...implies an aim of showing relative values or excellence by bringing out characteristic qualities whether similar or divergent (W)

rank - to determine or assign the relative rank or class of (W) Requires more discretion than grade.

inspect - [to compare critically] to a standard of excellence, quality, or the like, with a view toward noting discrepancies or deficiencies...(F&W)

distinguish - ...it suggests the making of even finer distinctions than compare or contrast and making them among things even more closely resembling each other. (S)

contrast - to compare with an aim of pointing out differences but not determining relative values (S)

select - to decide on one, or a few, from several possibilities; variables are readily apparent and the consequences are not as great as in determine and deliberate under "COORDINATE." (S)

choose - to decide on one of two alternatives; the variables and consequences are the same as in select. (S)

Classify - to group or segregate in classes that have systematic relations usually founded on common properties or characters. (W)

grade - to divide into groups based on ascending or descending order; relative rank or class is prescribed (S)

index - to classify information, usually on the basis of subject matter or name, to facilitate reference (S)

13 - DISCRIMINATING (Continued)

segregate - to separate or set apart from others or from the general mass (W)

sort - ...suggests the selection of items according to type; this process is closely related to the categorizing process indicated by "classify." (F&W)

match - to pair up or put in a set as possessing equal or harmonizing attributes (W)

arrange - ...most often indicates the shifting about of items according to plan, but without necessarily altering the items themselves (F&W)

14 - FIGURING - Performing arithmetic operations on and/or carrying out a prescribed action in relation to them. Does not include counting. (D.O.T.)

Estimate - to determine roughly the size, extent, or nature of (W) Not the same as forecast in "SYNTHESIZING"

Compute - to arrive at an answer by simple (arithmetic) means. (W) Compute is not to be confused with calculate (under "SYNTHESIZE") which applies to highly abstruse and problematical questions.

Plot - to determine the physical position of by mathematical means (S)

15 - COMPILING - Measuring and collecting information about data, people, or things (S)

Measure - to ascertain the quantity, mass, extent, or degree of in terms of a standard unit or fixed amount, usually by means of an instrument or container marked off in the units (W)

time - to determine...the time, duration, or rate of (W)

weigh - to ascertain the heaviness of usually by use of a balancing device. (S)

calibrate - to determine the graduations of (W)

Collect - to bring data together into a group... implies careful selection (S)

accumulate - to bring together by degrees or regular additions (W)

15 - COMPILING (Continued)

inventory	-	to make an itemized report or record of; take stock of (W)
count	-	to indicate or name by units or groups to find the total number of units involved (W)
observe	-	to obtain data through visual insnection (S)
smell	-	to examine the odor or scent of with the nose (S)
listen	-	to pay attention to sound; perceive with the ear....to be alert to catch an expected sound (W)

16 - COPYING - Transcribing, entering, or posting data (D.O.T.)

Record	-	to make a written note or account of (W)
post	-	to transfer (an entry or item) from one record to another (W)
tabulate	-	to put into tabular form (W)
list	-	to enumerate one after another (S)
transpose	-	to change the relative place or normal order of (W)
Duplicate	-	to make a duplicate, copy, or transcript of (W)
transcribe	-	to make a copy of (dictated or recorded matter) in longhand or on a typewriter (W)
quote	-	to write (a passage) from another usually with credit acknowledgment (W)

"PEOPLE" ACTIVITY VERB DEFINITIONS

20 - MENTORING - Dealing with individuals in terms of their total personality in order to advise, counsel, and/or guide them with regard to problems that may be resolved by legal, scientific, clinical, spiritual, and/or other professional principles. (D.O.T.)

Treat - To treat medically is to accept someone as a patient, to diagnose his illness, and to relieve it. (F&W)

prognosticate - ...to take a knowledgeable look at the symptoms of a disease in order to determine its likely outcome. (F&W)

diagnose - to identify (as a disease or condition) by symptoms or distinguishing characteristics (W)

prescribe - to recommend (medical treatment) with authority (W) (F&W)

Advise - ...to give a person facts that involve his own interests (F&W)

counsel - to advise seriously and formally after consultation so as to avoid rash actions (W)

console - ...to mitigate the serious grief felt by another (F&W)

reconcile - to restore to friendship, compatibility, or harmony (W)

Arbitrate - ...to act with absolute power to decide a dispute (W)

judge - to hear and determine or decide in the case of (as a person) in or as if in a court of justice (W); to make decisions or pass upon the merits of something (F&W)

21 - NEGOTIATING - Exchanging ideas, information, and opinions with others to formulate policies and programs and/or arrive jointly at decisions, conclusions or solutions. (D.O.T.)

Mediate - ...to attempt to bring extremes together or to function as a form of communication between them. (F&W)

21 - NEGOTIATING (Continued)

settle	-	...to reach a definite or final choice after a period of indecision or dispute (F&W)
debate	-	to argue formally, usually under the control of a referee and according to a set of regulations (F&W)
bargain	-	...to negotiate over the terms of a purchase, agreement, or contract. (W)
reason	-	to argue or discuss in a careful and painstaking manner in order to persuade or explore a subject in depth (F&W)
confer	-	to hold conversation or conference. Now typically on important, difficult, or complex matters. (W)

22 - EDUCATING - Developing the growth or expansion of knowledge, wisdom, desirable qualities of mind or character, physical health, or general competence especially by a course of formal study or instruction.(W)

Teach	-	...to apply a guided process of assigned work, discipline, directed study, and the presentation of examples. (F&W)
lecture	-	to deliver a discourse given before an audience especially for instruction (W)
tutor	-	to teach, guide, or instruct on an individual basis and in a special subject or for a particular occasion or purpose. (W)
explain	-	to clarify or make acceptable to understanding something that is mysterious, causeless, or inconsistent. (W)
instruct	-	to guide training or to impart information or commands (F&W)
Coach	-	to train intensively by instruction, demonstration, and repeated practice. (W)
demonstrate	-	to make evident or reveal as true by reasoning processes, concrete facts and evidence, experimentation, operation, or repeated examples. (W)
train	-	...to systematically develop the body or mind for the purpose of acquiring proficiency in some physical or mental pursuit. (F&W)

23 - SUPERINTENDING - Determining or interpreting work procedures for a group of workers, assigning specific duties to them, maintaining harmonious relations among them, and promoting efficiency. (D.O.T.)

Supervise - to stress guidance and the exercise of leadership of a group of workers (F&W)

lead - to take a principal or directing part in; have charge or direction of (W)

order - to issue commands (W)

appoint - to designate (a person) in whom shall be vested the responsibility of performing a given task (S) Syn: designate

assign - to delegate a task to one or more members of a group (F&W)

enforce - [To Require] operation, observance, or protection of laws, orders, contracts, and agreements by authority (W)

rate - to evaluate the work performance of a subordinate relative to specific standards (W)

24 - DIVERTING - to draw the mind away from serious thoughts or pursuits; distracting the attention from work, worry, pain, or commonplace concerns and focusing it on pleasure (F&W)

Entertain - ...to provide some occupation that will afford pleasure or relieve monotony or boredom (F&W)

humor - to comply with someone's moods, fancies, or capricious demands, though they may seem extreme (S)

interest - to excite or hold one's curiosity or attention (F&W); to engage or attract the attention of someone (W)

amuse - ...to provide any form of distraction that contents the mind (F&W)

imitate - ...to repeat convincingly or tellingly the recognizable features of the model; suggests following a model or pattern without precluding some variation (W)

25 - PERSUADING - Influencing others in favor of a product, service, or point of view. (D.O.T.)

- Influence - ...to bring about a change in another's actions or thoughts by persuasion (F&W)
  - motivate - to consciously attempt to stimulate the active interest or desire for something (S)
  - convince - to bring by argument to assent or belief. (W); compels one's belief in its soundness because it satisfies the sense of logic or fitness (F&W)
- Promote - ...to influence in an aggressive and deliberate manner, usually with a specific aim in mind (S)
- Solicit - to move to action; serve as an urge or incentive to (W)
- Sell - to give up to another for money or other valuable consideration (W)

26 - SPEAKING/SIGNALING - talking with and/or signaling people to convey or exchange information; includes giving assignments and/or directions to helpers or assistants (D.O.T.)

- Discuss - ...to talk over, usually in an informal, friendly way; discuss points to the elucidation of an issue rather than to the narrow presentation of one's own view. (F&W)
  - interview - to question or converse with especially in order to obtain information or ascertain personal qualities (W)
  - consult - to clarify a question with emphasis on motive without necessarily suggesting ultimate agreement (F&W)
  - question - to seek clarification or test knowledge of (S)
- Inform - ...to call someone's attention to something or to cause him to receive knowledge of it. (F&W)
  - dictate - to speak or read for a person to transcribe or for a machine to record (W)

26 - SPEAKING/SIGNALING (Continued)

answer	-	...to speak or write in reply to (W)
describe	-	...to cite details that will create a visual image in the mind of an audience (F&W)
indicate	-	...to stress a rough approximation of literal meaning of a sign or word (F&W)
relay	-	to pass along a message, signal (W)
request	-	to ask for a stated need with an expectation of response (S)
Meet	-	to come into the presence of (W)
greet	-	to meet or receive with a salutation (W)

27 - SERVING - attending to the needs or requests of the people or animals, or the expressed or implicit wishes of people. Immediate response is involved. (D.O.T.)

Assist	-	...to give support or aid to especially in some undertaking or effort; aid (W)
usher	-	to conduct to a place (W)
Attend	-	...to look after or take charge of (W)
wait upon	-	...to attend as a servant; to supply the want of (W)
Supply	-	to provide what is needed; sometimes to make up a deficiency, replacing losses or depletions, filling a gap (W)
provide	-	to equip, stock, or give in the interest of preparing with foresight (W)

ALPHABETIC INDEX OF THE "ACTIVITY VERB LIST"

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* Note: The first digit designates the major functional area: "1" - "Data;" "2" - "People." The second digit indicates the specific level of Worker Function where the Activity Verb is categorized.

ALPHABETIC INDEX OF THE "ACTIVITY VERB LIST" (Continued)

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